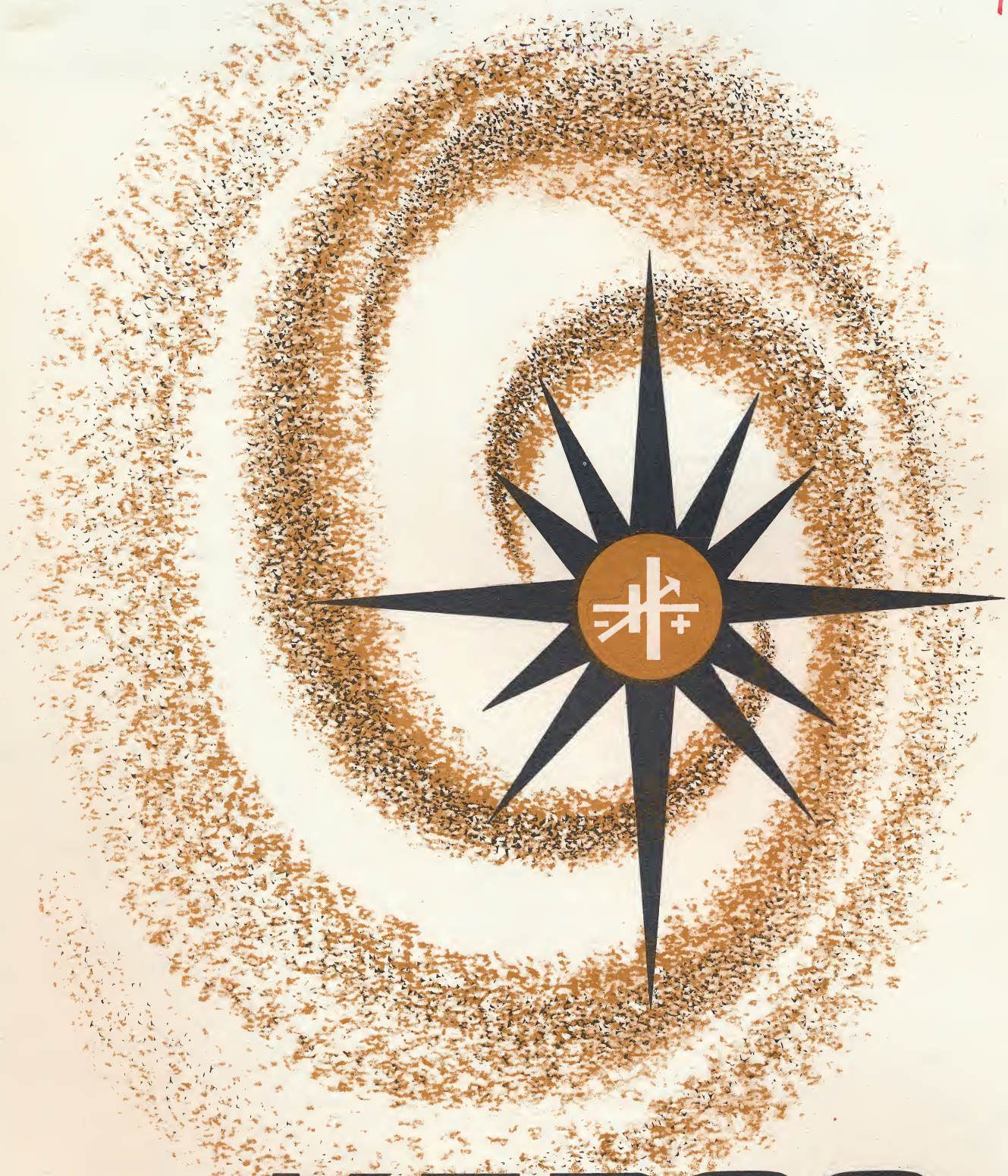
B-657

Note Glossary



KEPCO

POWER SUPPLIES

kepco®

DESIGN GROUP INDEX

ABC REGULATED DC SUPPLY
TRANSISTOR GROUP
0.05% REGULATION
Pages 14-15

ABC REGULATED DC SUPPLY
HYBRID GROUP
0.05% REGULATION
Pages 16-17

CK REGULATED DC SUPPLY
GROUP
0.01% REGULATION
Pages 18-19

HB REGULATED DC SUPPLY
GROUP
0.01% REGULATION
Pages 20-21

KO REGULATED DC SUPPLY
GROUP
1% REGULATION
Pages 22-23

KS REGULATED DC SUPPLY
GROUP
Pages 24-25

MODEL	DC OUTPUT VOLTS	DC OUTPUT AMPS
ABC 2–1M	0–2	0–1
ABC 7.5–2M	0–7.5	0–2
ABC 10–0.75M	0–10	0–0.75
ABC 15–1M	0–15	0–1
ABC 18–0.5M	0–18	0–0.5
ABC 30–0.3M	0–30	0–0.3
ABC 40–0.5M	0–40	0–0.5
ABC 100–0.2M	0–100	0–0.2
ABC 200M	0–200	0–0.1
ABC 425M	0–425	0–0.05
ABC 1000M	0–1000	0–0.02
ABC 1500M	0–1500	0–0.01
ABC 2500M	0–2500	0–0.002
CK 2–8M	0–2	0–8
CK 8–5M	0–8	0–5
CK 18–3M	0–18	0–3
CK 36–1.5M	0–36	0–1.5
CK 40–0.8M	0–40	0–0.8
CK 60–0.5M	0–60	0–0.5
HB 2AM	0–325	0–0.2
HB 4AM	0–325	0–0.4
HB 6AM	0–325	0–0.6
HB 8AM	0–325	0–0.8
HB 250M	0–250	0–1
HB 525M	0–525	0–0.5
KO 12–100M	0–12	0–100
KO 25–50M	0–25	0–50
KO 45–30M	0–45	0–30
KO 70–20M	0–70	0–20
KS 8–15M	0–8	0–15
KS 8–25M	0–8	0–25
KS 8–50M	0–8	0–50
KS 8–100M	0–8	0–100
KS 18–10M	0–18	0–10

kepco®

INDEX BY OUTPUT VOLTAGE

DC OUTPUT VOLTS	DC OUTPUT AMPS	MODEL	PAGE
0–2	0–1	ABC 2–1M	14-15
0–2	0–8	CK 2–8M	18-19
6.3	0–15	PRM 6–15	30-31
6.3	0–25	PRM 6–25	30-31
0–7	0–1	PAX 7–1	26-27
0–7.5	0–2	ABC 7.5–2M	14-15
0–8	0–5	CK 8–5M	18-19
0–8	0–15	KS 8–15M	24-25
0–8	0–25	KS 8–25M	24-25
0–8	0–50	KS 8–50M	24-25
0–8	0–100	KS 8–100M	24-25
0–10	0–0.75	ABC 10–0.75M	14-15
0–12	0–100	KO 12–100M	22-23
0–12	0–7	PWR 12–7	32-33
12	0–10	PRM 12–10	30-31
12	0–15	PRM 12–15	30-31
0–14	0–7	SM 14–7M	34-35
0–14	0–15	SM 14–15M	34-35
0–14	0–30	SM 14–30M	34-35
0–15	0–0.75	PAX 15–0.75	26-27
0–15	0–1	ABC 15–1M	14-15
0–15	0–6	PWR 15–6	32-33
0–7.5–15	0–10	PR 15–10M	28-29
0–15	0–30	PR 15–30M	28-29
0–18	0–0.5	ABC 18–0.5M	14-15
0–18	0–3	CK 18–3M	18-19
0–18	0–10	KS 18–10M	24-25
0–18	0–15	KS 18–15M	24-25
0–18	0–25	KS 18–25M	24-25
0–18	0–50	KS 18–50M	24-25
18	0–6.7	PRM 18–6.7	30-31
18	0–10	PRM 18–10	30-31
0–20	0–100	PR 20–100AM	28-29
0–21	0–0.5	PAX 21–0.5	26-27

kepco®

DESIGN GROUP INDEX

KS REGULATED DC SUPPLY GROUP
0.01% REGULATION
Pages 24-25

PAX REGULATED DC SUPPLY MODULAR GROUP
0.05% REGULATION
Pages 26-27

SINGLE PHASE INPUT MODELS
±1% LINE REGULATION

PR REGULATED DC SUPPLY GROUP
Pages 28-29

3-PHASE INPUT MODELS
±2% LINE REGULATION

MODEL	DC OUTPUT VOLTS	DC OUTPUT AMPS
KS 18–15M	0–18	0–15
KS 18–25M	0–18	0–25
KS 18–50M	0–18	0–50
KS 36–5M	0–36	0–5
KS 36–10M	0–36	0–10
KS 36–15M	0–36	0–15
KS 36–30M	0–36	0–30
KS 60–2M	0–60	0–2
KS 60–5M	0–60	0–5
KS 60–10M	0–60	0–10
KS 60–20M	0–60	0–20
PAX 7–1	0–7	0–1
PAX 7–1HS	0–7	0–1
PAX 15–0.75	0–15	0–0.75
PAX 15–0.75HS	0–15	0–0.75
PAX 21–0.5	0–21	0–0.5
PAX 21–0.5HS	0–21	0–0.5
PAX 36–0.3	0–36	0–0.3
PAX 36–0.3HS	0–36	0–0.3
PAX 72–0.15	0–72	0–0.15
PAX 72–0.15HS	0–72	0–0.15
PAX 100–0.1	0–100	0–0.1
PAX 100–0.1HS	0–100	0–0.1
PR 15–10M	0–7.5–15	0–10
PR 15–30M	0–15	0–30
PR 38–5M	0–19–38	0–5
PR 38–15M	0–38	0–15
PR 80–2.5M	0–40–80	0–2.5
PR 80–8M	0–80	0–8
PR 155–1M	0–78–155	0–1
PR 155–4M	0–155	0–4
PR 220–3M	0–220	0–3
PR 310–0.6M	0–165–310	0–0.6
PR 310–2M	0–310	0–2
PR 20–100AM	0–20	0–100
PR 40–50AM	0–40	0–50
PR 50–40AM	0–50	0–40

kepco®

INDEX BY OUTPUT VOLTAGE

DC OUTPUT VOLTS	DC OUTPUT AMPS	MODEL	PAGE
0–24	0–4	PWR 24–4	32-33
24	0–5	PRM 24-5	30-31
24	0–8	PRM 24–8	30-31
0–25	0–50	KO 25–50M	22-23
0–28	0–3.3	PWR 28–3.3	32-33
28	0–4.3	PRM 28–4.3	30-31
28	0–7	PRM 28–7	30-31
0–30	0–0.3	ABC 30–0.3M	14-15
0–36	0–0.3	PAX 36–0.3	26-27
0–36	0–1.5	CK 36–1.5M	18-19
0–36	0–5	KS 36–5M	24-25
0–36	0–5	SM 36–5M	34-35
36	0–3.3	PRM 36–3.3	30-31
36	0–5	PRM 36–5	30-31
0–36	0–10	KS 36–10M	24-25
0–36	0–10	SM 36–10M	34-35
0–36	0–15	KS 36–15M	24-25
0–36	0–15	SM 36–15M	34-35
0–36	0–30	KS 36–30M	24-25
0–19–38	0–5	PR 38–5M	28-29
0–38	0–15	PR 38–15M	28-29
0–40	0–0.5	ABC 40–0.5M	14-15
0–40	0–0.8	CK 40–0.8M	18-19
0–40	0–50	PR 40–50AM	28-29
0–45	0–30	KO 45–30M	22-23
0–48	0–2	PWR 48–2	32-33
48	0–2.5	PRM 48–2.5	30-31
48	0–4	PRM 48–4	30-31
0–50	0–40	PR 50–40AM	28-29
0–60	0–0.5	CK 60–0.5M	18-19
0–60	0–2	KS 60–2M	24-25
0–60	0–5	KS 60–5M	24-25
0–60	0–10	KS 60–10M	24-25

kepco®

DESIGN GROUP INDEX

PRM REGULATED DC SUPPLY
MODULAR GROUP
±1% LINE REGULATION
Pages 30-31

PWR REGULATED DC SUPPLY
MODULAR GROUP
0.005% LINE
0.05% LOAD REGULATION
Pages 32-33

SM REGULATED DC SUPPLY
GROUP
0.01% LINE
0.05% LOAD REGULATION
Pages 34-35

MODEL	DC OUTPUT VOLTS	DC OUTPUT AMPS
PRM 6–15	6.3	0–15
PRM 6–25	6.3	0–25
PRM 12–10	12	0–10
PRM 12–15	12	0–15
PRM 18–6.7	18	0–6.7
PRM 18–10	18	0–10
PRM 24–5	24	0–5
PRM 24–8	24	0–8
PRM 28–4.3	28	0–4.3
PRM 28–7	28	0–7
PRM 36–3.3	36	0–3.3
PRM 36–5	36	0–5
PRM 48–2.5	48	0–2.5
PRM 48–4	48	0–4
PRM 60–2	60	0–2
PRM 60–3	60	0–3
PRM 120–1	120	0–1
PRM 120–1.5	120	0–1.5
PWR 12–7	12	0–7
PWR 15–6	15	0–6
PWR 24–4	24	0–4
PWR 28–3.3	28	0–3.3
PWR 48–2	48	0–2
PWR 60–1.5	60	0–1.5
SM 14–7M	0–14	0–7
SM 14–15M	0–14	0–15
SM 14–30M	0–14	0–30
SM 36–5M	0–36	0–5
SM 36–10M	0–36	0–10
SM 36–15M	0–36	0–15
SM 75–2M	0–75	0–2
SM 75–5M	0–75	0–5
SM 75–8M	0–75	0–8
SM 160–1M	0–160	0–1
SM 160–2M	0–160	0–2
SM 160–4M	0–160	0–4
SM 325–0.5M	0–165–325	0–0.5
SM 325–1M	0–325	0–1
SM 325–2M	0–325	0–2

kepco®

INDEX BY OUTPUT VOLTAGE

DC OUTPUT VOLTS	DC OUTPUT AMPS	MODEL	PAGE
0–60	0–20	KS 60–20M	24-25
0–60	0–1.5	PWR 60–1.5	32-33
60	0–2	PRM 60-2	30-31
60	0–3	PRM 60–3	30-31
0–70	0–20	KO 70–20M	22-23
0–72	0–0.15	PAX 72–0.15	26-27
0–75	0–2	SM 75–2M	34-35
0–75	0–5	SM 75–5M	34-35
0–75	0–8	SM 75–8M	34-35
0–40–80	0–2.5	PR 80–2.5M	28-29
0–80	0–8	PR 80–8M	28-29
0–100	0–0.1	PAX 100–0.1	26-27
0–100	0–0.2	ABC 100–0.2	14-15
120	0–1	PRM 120–1	30-31
120	0–1.5	PRM 120–1.5	30-31
0–78–155	0–1	PR 155–1M	28-29
0–155	0–4	PR 155–4M	28-29
0–160	0–1	SM 160–1M	34-35
0–160	0–2	SM 160–2M	34-35
0–160	0–4	SM 160–4M	34-35
0–200	0–0.1	ABC 200M	16-17
0–220	0–3	PR 220–3M	28-29
0–250	0–1	HB 250M	20-21
0–300 0–300	0–0.075 0–0.075	103 Unregulated	36-37
0–165–310	0–0.6	PR 310–0.6M	28-29
0–310	0–2	PR 310–2M	28-29
0–165–325	0–0.5	SM 325–0.5M	34-35
0–325	0–0.2	HB 2AM	20-21
0–325	0–0.4	HB 4AM	20-21
0–325	0–0.6	HB 6AM	20-21
0–325	0–0.8	HB 8AM	20-21
0–325	0–1	SM 325–1M	34-35

kepco®

DESIGN GROUP INDEX

MODEL		DC OUTPUT VOLTS	DC OUTPUT AMPS
2400 B	#1	Bias	
		0—150	0—0.005
	#2	0—400	0—0.15
	#3	0—400	0—0.15
Parallel	#2 & #3	0—400	0—0.3
Series	#2 & #3	0—800	0—0.15
400B		0—400	0—0.15
		Bias	
		0—150	0—0.005
430 D	#1	0—450	0—0.3
	#2	0—450	0—0.3
Parallel	#1 & #2	0—450	0—0.6
Series	#1 & #2	0—900	0—0.3
800 B	#1	0—600	0—0.2
	#2	0—600	0—0.2
Parallel	#1 & #2	0—600	0—0.4
Series	#1 & #2	0—1200	0—0.2
605		0—600	0—0.5
		Bias	
		0—150	0—0.005
615B		0—600	0—0.3
		Bias	
		0—150	0—0.005
103	#1	0—300	0—0.075
Unregulated	#2	0—300	0—0.075
	#3	−50 to+50	0—0.005
Parallel	#1 & #2	0—300	0—0.15
1250 B		0—1000	0—0.5
1220 C		0—1200	0—0.05
1520 B		0—1500	0—0.2
HB 2050		0—2000	0—0.5
HB 2500		0—2500	0—0.05

WR REGULATED DC SUPPLY

GROUP

< 0.1% REGULATION

Pages 36-37

kepco®

INDEX BY OUTPUT VOLTAGE

DC OUTPUT VOLTS	DC OUTPUT AMPS	MODEL	PAGE
0—325	0—2	SM 325—2M	34-35
0—400 0—150 bias	0—0.15 0—0.005	400B	36-37
0—400 0—400 0—150 bias	0—0.15 0—0.15 0—0.005	2400B Multiple Output	36-37
0—425	0—0.05	ABC 425M	16-17
0—450 0—450	0—0.3 0—0.3	430D Multiple Output	36-37
0—525	0—0.5	HB 525M	20-21
0—600 0—150 bias	0—0.3 0—0.005	615B	36-37
0—600 0—600	0—0.2 0—0.2	800B Multiple Output	36-37
0—600 0—150 bias	0—0.5 0—0.005	605	36-37
0—1000	0—0.02	ABC 1000M	16-17
0—1000	0—0.5	1250B	36-37
0—1200	0—0.05	1220C	36-37
0—1500	0—0.01	ABC 1500M	16-17
0—1500	0—0.2	1520B	36-37
0—2000	0—0.5	HB 2050	36-37
0—2500	0—0.002	ABC 2500M	16-17
0—2500	0—0.05	HB 2500	36-37

TABLE OF CONTENTS

POWER SUPPLY SPECIFICATIONS:

. . . a reliable source for all of your Regulated DC Power Supply needs

ORDERING INFORMATION

All of the power supplies described in this catalog are regular production items, not specials, not "built to order". Our inventory will, at almost any given time, contain substantial quantities of 80-85% of all of the listed models. Your local Kepco Field Engineering Office receives weekly inventory reports and is equipped to quote price and delivery directly.

Communications:

Kepco maintains complete communication facilities including postal, telephone, Western Union (WUX) and teletype (TWX) facilities:

Mail Address and WUX.....**131-38 Sanford Ave., Flushing, N. Y. 11352**
Telephone Number .....**(212) IN 1-7000**
TWX Number **212-539-6623**
Cable Address ..... **KEPCOPOWER NEWYORK**

Orders:

Please use the Kepco model number to describe the power supply that you want. If your organization has assigned specification control numbers to our standard models, please list our model number also to assist our order processing department in filling your order with least delay. Unless otherwise specified, orders are shipped via motor freight. Liaison is maintained with all shipping agencies and Metropolitan New York Airports.

Warrantee:

All Kepco products are backed by a **valid, unconditional** repair guarantee — for one year after date of sale. Our entire staff of nationwide representative field engineers are factory trained to assist you in obtaining the best performance from each Kepco Power Supply. Each field engineer is prepared to render on-the-spot field service and many of our representative organizations maintain full service centers for overhaul and maintenance. For the address and telephone number of your local Kepco Field Engineer, refer to the back cover of this catalog

Parts:

Recognizing the importance of providing proper equipment support after delivery to our customers, Kepco maintains a complete inventory of every component needed to service any Kepco Power Supply **regardless of age.** When writing to us or to our local field representative organization concerning spare parts, please refer to the model and serial number of the equipment involved. Also give a description of the part and the Kepco part number.

KEPCO LITERATURE

This catalog is one of a number of Kepco publications designed to assist you in the selection and application of Regulated Power Supplies. Kepco publications include: "Kepco Power Supply Handbook", reprints of current technical papers and a bi-monthly newspaper, the Kepco Power Supply News.

1. KEPCO POWER SUPPLY HANDBOOK

This handbook presents the basic theory of Regulated Power Supply design, including a detailed treatment of the Kepco comparison bridge regulator, systems interconnections, programming techniques, and applications data.

2. TECHNICAL PAPERS

Kepco's engineers are continuously engaged in a research effort to extend the dimensions of the Power Supply art. Their work is regularly published and reprints are available to interested Power Supply users.

3. KEPCO POWER SUPPLY NEWS

A technical journal published bi-monthly with articles and news stories reporting developments in the Power Supply field.

For a complimentary copy of the "Kepco Power Supply Handbook", reprints of technical papers, or a subscription to the Kepco Power Supply News, write:

Publications Manager, KEPCO, INC.,
131-38 Sanford Ave., Flushing, N.Y. 11352

Copies of these Kepco publications are also available through Kepco's field representatives.

131-38 SANFORD AVENUE • FLUSHING, N.Y. 11352 • Phone: (212) IN 1-7000
TWX #212-539-6623 • Cable Address: KEPCOPOWER, NEWYORK

kepco®

the specialist in dc regulated power supplies

Kepco, after 19 years, continues as a leading contributor to the art of power supply design. Kepco's specialization and concentration in Regulated Power Supplies is supported by extensive research, design and manufacturing facilities. Two large plants house the Electronics Laboratory, Magnetics Laboratory, manufacturing facility and offices.

Value engineering, stressing reliability and versatility, are keynotes at Kepco; a fact that can be attested to by thousands of critical users. Elaborate laboratory test facilities and extensive production testing are designed to maintain a high level of quality control. This, together with outstanding engineering, result in a quality product whose many patented features make the difference in performance, exceptional long life and the reliability expected of all Kepco power supplies.

To maintain Kepco's traditional product superiority, a Quality Assurance Program is in effect through all phases of the manufacturing operation. This program, conforming basically to MIL Q-9858, is approved by leading contractors to the U. S. Military Services. Many thousands of power supply installations, reporting negligible down time, are testimonials to Kepco's engineering and manufacturing skills.

KEPCO'S CONTRIBUTIONS TO THE POWER SUPPLY FIELD

- **Short Circuit Protection by Current Limiting**
- **Full Range Regulation**
- **Efficient Slave Pass Circuit**
- **Elimination of Voltage Overshoot**
- **Remote Programming**
- **Remote Error Sensing**
- **Hybrid Regulators**
- **Thermal Protection**
- **High Efficiency Lateral Cooling**
- **The Flux-O-Tran Line Regulator**
- **Versatile Programmable Modules**
- **VIX Indicators and Signalling**
- **Programming Devices**
- **Automatic Crossover Voltage/Current Regulators**
- **Voltage Comparison Bridge Regulator**
- **Wide Range Magnetic Regulator**
- **Proportional Control of Multiple Systems**

Having set the pace in the power supply field, Kepco continues to improve concepts and design techniques to meet the needs of advanced electronic systems.

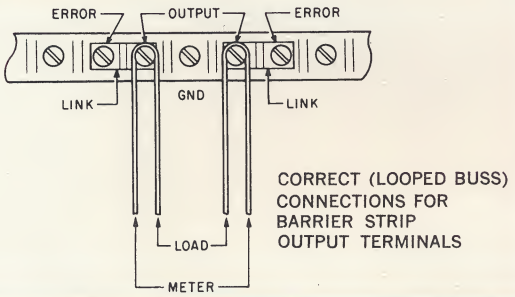
■ Patents issued and pending, Patent numbers available on request.

APPLICATION NOTES

Below and on the following pages are some application notes, nomographs and a glossary of terms to assist the engineer in the proper selection, application and understanding of Regulated Power Supplies. For complete information, write for the "Kepco Power Supply Handbook."

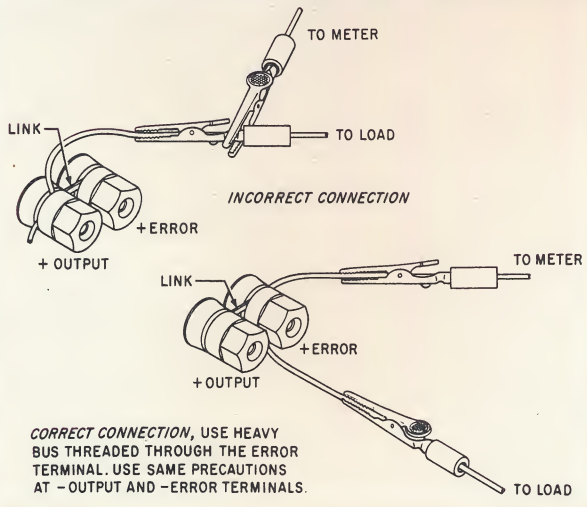
MEASUREMENTS

To properly measure regulation, ripple, stability and other performance characteristics of precision DC power supplies, considerable care in the use of sensitive instrumentation is required. In particular, one must avoid introducing excessive errors through the way in which the instrumentation is connected. Of particular concern are the voltage drops which occur in the connections to the output terminals and in the wiring to the load. The resistance of connections and wires is often overlooked, yet even a few milliohms in a critical measuring path can introduce sufficient error as to render the measurement meaningless.



CORRECT (LOOPED BUSS) CONNECTIONS FOR BARRIER STRIP OUTPUT TERMINALS

As an example, consider a Model KS 36-10M; 36V, 10A, 0.01% regulated power supply. The 0.01% figure means that the output voltage will not vary by more than 3.6 millivolts, as load current is changed from 0 to 10 amperes. This is equivalent to an internal resistance of 0.36 milliohms. Any resistance of comparable magnitude in the current carrying portions of the output circuit will greatly degrade the regulation and must be avoided. Ordinary 4-terminal network theory is applicable and must be strictly followed. The important thing is to be certain that the measuring points are physically identical to the error sensing points. The sketches show some common errors in measuring technique, and the recommended correct procedure.



CORRECT CONNECTION, USE HEAVY BUS THREADED THROUGH THE ERROR TERMINAL. USE SAME PRECAUTIONS AT –OUTPUT AND –ERROR TERMINALS.

The wire drop nomograph on Page 13 shows that #10 gage wire will drop 10 mv per foot at 10 amperes current flow. One foot of wire is equivalent to six inches of wire at each of the plus and minus output terminals. The 10 mv loss is three times larger than the 3.6 millivolt figure which should be measured. Considering that a typical 0.01% power supply will often yield better than 0.001% regulation, measurements must be sensitive to very small fractions of a millivolt, and the magnitude of the wire drop problem becomes apparent.

It should be evident that remote error sensing is essential for all high precision applications of low voltage, high current power supplies. Remote error sensing permits the user to compensate for line drops (usually up to 0.5 volts per lead) so that the rated regulation performance of the power supply is obtained directly at the load.

THE MINIMUM "DELTA V"

Many regulation specifications are expressed as a fixed percentage **or x volts** ($\triangle V$) change, whichever is greater. Similarly, current regulation specifications will sometimes state a minimum delta I qualifier along with the rated percentage change. This form is required so that an accurate specification can be written on a **variable** parameter. Using voltage as an example, most power supplies are capable of a range of output voltages; from zero to some rated voltage is typical. A constant percentage specification would obviously rapidly require zero error as zero volts is approached; but, since the regulated power supply, like any feedback mechanism, requires a finite error signal to actuate the process of regulation, there is a minimum error which must exist. This minimum error represents a measure of the power supply's resolution and sensitivity.

The minimum delta V ($\triangle V$) figure is used to determine the performance that can be expected whenever a power supply is used at less than its maximum output rating. A 0.01% or 0.5 millivolt, (whichever is greater) rating, means that at least 0.01% performance will be obtained at voltages as low as 5 volts; even at 1 volt output, the performance would be no worse than 0.05%. By contrast, a power supply rated 0.01% or 5 millivolts, whichever is greater, cannot deliver 0.01% performance below 50 volts, and at 1 volt output is down to 0.5 percent. The "minimum delta" portion of any specification is equally as important as the rated percentage and must not be overlooked when comparing specifications.

DYNAMIC IMPEDANCE

The source impedance presented by a power supply to its load is a complex frequency-dependent number. It consists of an equivalent resistance determined by the power supply's regulation specification (a function of the comparison amplifier's gain), a reactive component dependent on the output filter capacitor and a reactive component which depends on the wiring inductance. The capacitive reactance is effective only at low frequencies and so is usually swamped out by the amplifier gain. The inductive component becomes the predominant part of the impedance at frequencies above approximately 10 kc. Impedance is usually specified as the maximum complex (resultant) impedance within a given frequency band.

The effective series inductance is also given so that the impedance can be computed for frequencies above 10 kc.

The given inductance figure does not, of course, include the inductance of the load connecting wires. Assuming a straight, wire, the self inductance can be computed by the formula.

L (in μh) $= 0.005\, l\, [2.3 \log 4l/d - 0.75]$

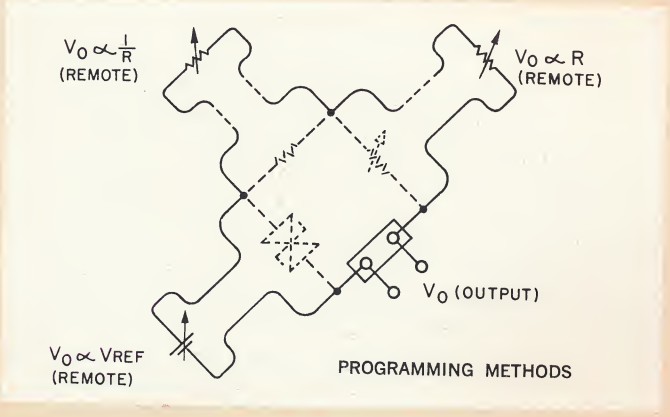
where l is the length of wire, and d its diameter, both in inches.

Many circuits depend upon the decoupling effect of a power supply's low source impedance. It is evident from the foregoing that this decoupling, and the entire transient behavior of the supply is strongly influenced by the inductance of the load connecting wires. Remote error sensing does **not** compensate for this effect since the sensing wires themselves have as much inductance as the load wires.

The following procedures are recommended to minimize the effect of wiring inductance: wherever possible, load wires should be twisted together and should be of the heaviest possible gage since this will minimize the inductance. Similarly, remote error sensing wires should be twisted together. To establish a low source impedance **at the load,** at frequencies where the line inductance is significant, a capacitor bypass **directly at the load terminals** is very useful. Such a capacitor acts as a local energy source, compensating for the load wiring inductance. When particularly long sensing leads are used, it is sometimes helpful to connect local sensing bypass capacitors **at the power supply.** These would be placed between the individual plus and minus output terminal and their respective error sensing terminal. They serve to bypass the combination load-wire and sense-wire inductance and prevent transient instability.

OUTPUT VOLTAGE PROGRAMMING

The unique Kepco comparison bridge circuit enables all Kepco **programmable** Power Supplies to be externally controlled over their entire output voltage range. All of the models listed on Page 42 have provision for purely resistive programming. In addition, ABC, CK, PAX, KS, PWR, KO models have provision for remote programming by means of external resistances, or voltage sources; or may be inversely resistance programmed. HB models are easily modified for programming with remote voltage sources and for inverse programming.



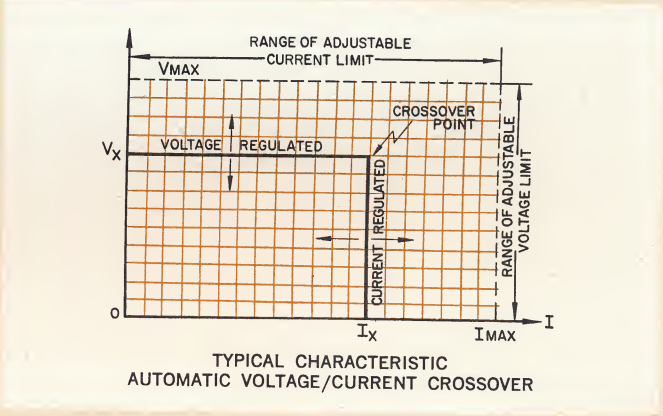
PROGRAMMING METHODS

For a detailed treatment of the programming feature, refer to the "Kepco Power Supply Handbook." See page 6.

CONSTANT CURRENT OPERATION

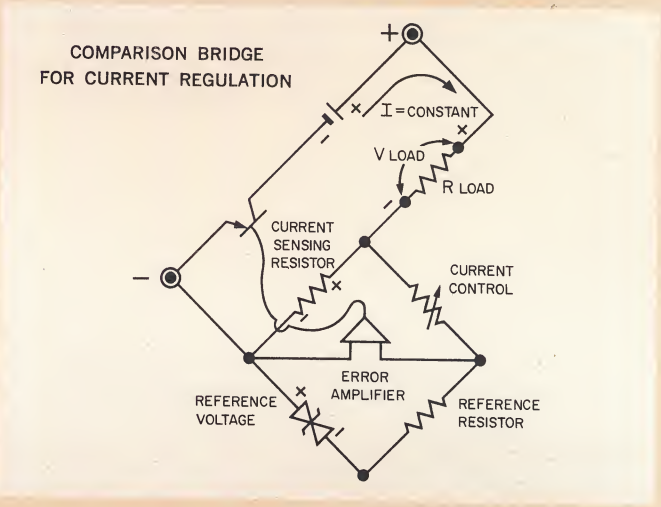
Current control is achieved by sensing a small sample voltage developed across a resistor placed in series with the load. The power supply is controlled so as to maintain this sample voltage constant, thus providing current regulation. In such operation, the voltage across the load changes in direct proportion to the load resistance, and is known as the voltage compliance. The maximum compliance is equal to the output voltage range of the Power Supply.

Kepco CK, KS and KO models incorporate two regulator bridge circuits and a unique gate which automatically switches the mode of operation between them from constant voltage to constant current depending on the relative settings of the voltage and current controls and on the load resistance. This feature is called "Automatic Crossover".



TYPICAL CHARACTERISTIC
AUTOMATIC VOLTAGE/CURRENT CROSSOVER

Power supplies with the automatic crossover feature can be remotely controlled in either or both modes by means of remote resistances or voltage sources, or they can be inversely resistance programmed (see output voltage programming). These models can also be operated in the constant current mode using an external sensing resistor. When employing "external sensing", current control is achieved with an external programming resistance or voltage source, or it can be inversely resistance programmed. The Kepco ABC, PAX and HB models can be operated in the constant current mode using external sensing and programming only.



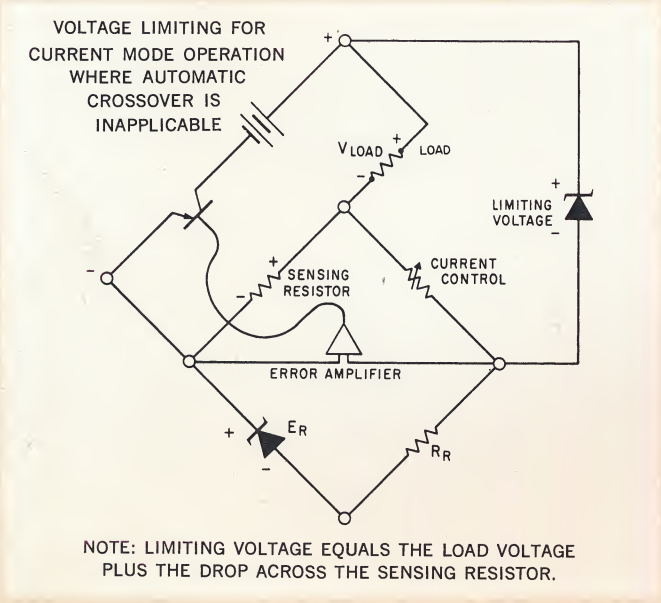
The external current sensing resistor carries the full load current and in all-transistor models is selected to drop 1 volt at the operating current. For HB models, and the hybrid units in the ABC design group, the sensing resistor is selected to drop 10 volts at the operating current. This resistor should have a low temperature coefficient and should be conservatively rated for power dissipation. At least a ten times derating factor is recommended. The current control rheostat used to vary the current, carries only the control bridge current of the power supply, either 1 ma or 10 ma as the case may be. This current control can be used to vary the output current (for a fixed sensing resistor) over as much as a 10:1 ratio.

VOLTAGE LIMITING

Some form of overload (voltage) limiting for power supply operation in the current regulation mode is a desirable feature. Adjustable limiting is, of course, provided in all automatic crossover power supplies where the voltage control setting serves as the upper limit to the voltage compliance. When external sensing is used to generate current regulation, or non-automatic crossover power supplies are set up for current regulation, voltage limiting must be provided by external means.

A current regulator, in the ideal sense, will treat any open circuit as if it were an overload. The terminal voltage will rise toward infinity as the supply tries to maintain its pre-set current through the infinite load resistance. Actually, of course, the "infinite" voltage is limited to the maximum available raw DC that the transformer-rectifiers can generate. This is dependent on line voltage, but is usually about 150% of the supply's regulated output rating (or band switch position in an HB model). When the output voltage reaches this maximum it **is** limited, and so the current cannot be maintained through the load. This constitutes the overload condition for a current regulator.

It may be desirable to introduce voltage limiting in such power supplies so that the limiting point would be independent of line voltage or would be at a lower value to protect a load. Such limiting is easily introduced by means of appropriate zener diodes. A zener diode of appropriate voltage breakdown rating would be connected across the power supply's **Remote Programming** terminals, found at the rear of all such power supplies.



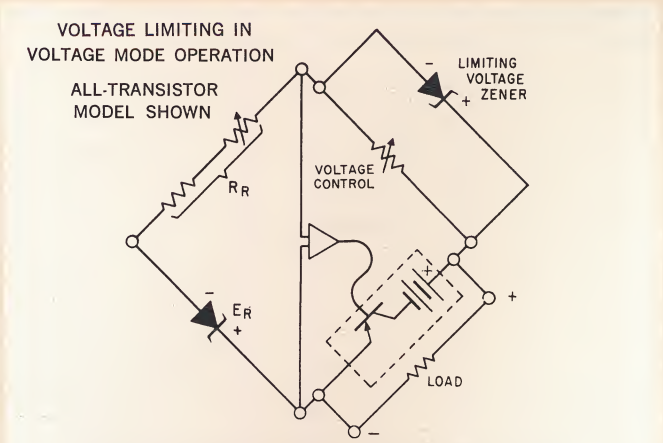
NOTE: LIMITING VOLTAGE EQUALS THE LOAD VOLTAGE PLUS THE DROP ACROSS THE SENSING RESISTOR.

When the compliance voltage (output voltage) of the power supply is less than the zener breakdown rating, the diode does not conduct and has no effect upon the power supply's performance. When the voltage tries to exceed the zener rating, the diode will conduct causing the voltage to be limited to the zener rating.

The maximum zener current would equal the rated bridge current of the power supply in question. 1 ma or 10 ma are typical values (control ratios of 1000 ohms/volt and 100 ohms/volt respectively).

This light current permits the use of relatively small inexpensive zeners even though the current rating of the power supply may be dozens of amperes. Since zeners can be obtained in a variety of voltage breakdown ratings, and can be series connected if desired, this method offers a quick and inexpensive way of obtaining fixed voltage limiting. Because the zener 'knee" is not likely to be particularly sharp at the light bridge current, it is recommended that the zener be selected for at least 10% excess voltage above the maximum desired compliance.

It should be noted that voltage limiting is not restricted to current regulators. Many **voltage regulator** operations require that the voltage not exceed a particular setting. A zener limiter can guard against inadvertent operator error, improper adjustment, etc. Of course, for critical loads, positive fail safe protection can be obtained with a VIP Load Protector—see Accessory Page 45.



MAXIMUM OUTPUT VOLTAGE EQUALS ZENER VOLTAGE OF LIMITING DIODE.

MORE ON USING CURRENT REGULATION

As has been previously described, an open circut load constitutes an overload to the pure current regulator just as a short circuit represents an overload for a pure voltage regulator.

In both instances, the power supply will attempt to maintain its regulated voltage or current through the load, increasing the other parameter, current or voltage, toward infinity as needed. When further increase becomes impossible, the power supply is said to "drop out of regulation" or become overloaded. An overload, in either mode, will not damage a well designed power supply, but it may cause some problems in application which require consideration.

Voltage regulation, because it is the historically dominant "natural" mode of operation, does not generate any real problem. No one would consider shorting out the terminals of a voltage regulator (battery) preliminary to the application of a load. If this were done, the overload would cause the voltage source potential to collapse and it would then have to build back up to its original voltage across the load.

Precisely the same dual situation prevails for current regulation although it is often overlooked. The proper way to apply a load is to start off from a short circuit, apply the load, then remove the short. To neglect this by applying the load to previously open circuited load terminals forces the current regulator to recover from its overload and gradually build up the load current from zero. Unfortunately, because the power supply contains an output filter capacitor, the excess terminal voltage will not instantly disappear—rather, it decays at the RC time constant that the load makes with the filter capacitor. This initial pulse of voltage can damage some sensitive loads and is to be avoided. The way to avoid it is to practice the correct "short circuit first" procedure for applying a load to a current source.

A way of remembering this is to recall that a load should always be applied to an idling power supply. In voltage mode the open circuit (no current) is idle. In current mode, the short circuit (no voltage) is idle.

Strictly, automatic crossover power supplies cannot be "overloaded" by either open or short circuits, since the power supply will always switch to whatever mode is appropriate for the loading. The same rules apply, however, so far as connecting the load is concerned. The only difference is that the mode of operation can easily be chosen by the user and his loading procedure tailored to fit.

PROGRAMMING SPEED

The PROGRAMMING SPEED (or RECOVERY TIME for CURRENT REGULATED operation) cannot, strictly, be specified independently for a power supply. These two parameters are identical and are functionally dependent on the RC time constant that the **load** resistance makes with the output filter capacitor. In addition, the current mode recovery time is modified by the charging time of the output capacitor, a linear function of the current setting.

In general, when the power supply is lightly loaded, the output capacitor can be charged rapidly but discharges more slowly. For heavy loading the contrary situation prevails with a slow charging time but relatively rapid discharge. At approximately 50% loading, the charging and discharging speeds are equal and for most supplies equals about 250 volts per second, which corresponds to the maximum programming speed.

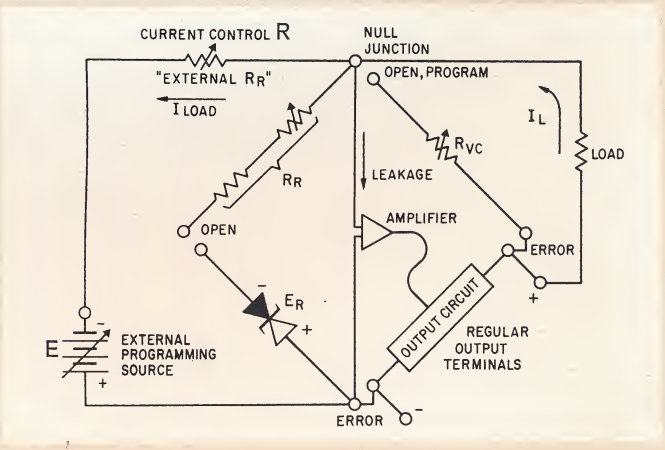
In current mode, the recovery time can also be expressed in volts per second, dv/dt, since the recovery time is the time that it takes for the voltage to change from one steady state value to another. A falling voltage follows the exponential decay of the filter capacitor through the remaining load resistance. For purposes of calculation, the equivalent output capacitance can be taken as approximately $C_{EQ} = I_O/250$, where I_O equals the current rating of the power supply. A rising voltage also follows an exponential except that it is additionally limited by the capacitor charging rate of the current control setting. This can be determined by the ratio of the current setting I_S to the power supply's current rating I_O. The rate of increasing voltage change, $dv/dt = (250)(I_S/I_O)$. Once the rate dv/dt has been approximated, the recovery time is easily computed for any selected voltage compliance swing.

SMALL CURRENT REGULATION

The conventional sampling techniques for current regulation do not permit operation down to zero current. With the fixed sensing resistor used for internal current sampling, for example, a lower current limit is imposed by the vanishingly small sample voltage as current approaches zero. When this sample voltage falls below the resolution limit of the amplifier, it becomes lost in the noise and regulation is no longer possible. When an external sensing resistor is employed, and the resistance can be increased to compensate for the vanishing current, the lower current limit is then imposed by the power supply's own control bridge current. This current circulates counter to the normal direction of output current and so opposes the voltage drop in the sensing resistor. When the output current equals the bridge current, the two in fact cancel, and the sampling signal approaches zero.

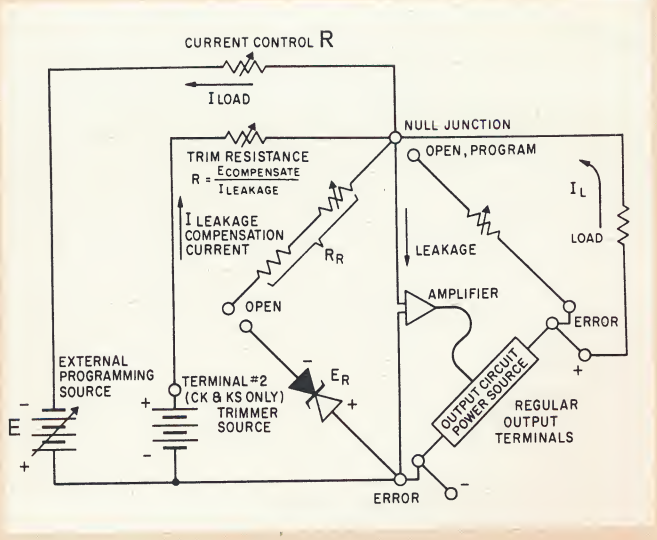
It is possible to circumvent these limits and control very small currents by using a non-sampling current regulation method, taking advantage of the isolation properties of the null junction. Since the null junction is at virtual ground potential, the current through it depends only upon the ratio E_R/R_R, and is unaffected by the value of the voltage control resistance, or the loading of the output terminals. This provides the constant bridge current in normal operation. To use this current, it is only necessary to substitute the load for the voltage control, using the power supply's "programming" terminals for this purpose. The programming terminals will, in effect, become the new output terminals. The regular output terminals will not be used for anything, except that they do repeat the load compliance voltage and so are useful for metering or driving proportional loads. The output current is given by E_R/R_R, the reference voltage divided by the reference resistor. It can be adjusted at will by varying this ratio. Variations in E_R provide a linear direct control while variations in R_R result in a non-linear inverse $1/R_R$ control.

The existing fixed value E_R is derived from a zener diode. To control the output current, an external variable source can be substituted for E_R; the voltage is not important so long as it can deliver the desired current. For whatever voltage is available, select a suitable series resistor to substitute for R_R so that the ratio E/R equals the desired load current. While it is possible to use the existing zener reference, E_R (at least in CK and KS power supplies where the needed access terminals are provided) it should be noted that this restricts the MAXIMUM current to no more than the value of the original bridge current for the supply. Moreover, when the output current is varied, some sacrifice in stability will be introduced by the resulting variations in current through the zener reference diode.



When connected as shown, excellent small-current regulation will be obtained, equal to the power supply's abilities as a voltage regulator, and limited only by the stability of the source chosen for programming. The minimum current that can be regulated is determined by the amplifier leakage, a small current on the order of 4-15 microamperes flowing into the amplifier connection at the null junction. For control over exceedingly small currents, a cancellation technique is useful to eliminate the effect of this leakage. This consists of supplying an external source of current to cancel the leakage flow through the load. For All-Transistor models, a positive source is required relative to the minus output terminal of the power supply. For Hybrid supplies, a negative potential with respect to the plus output terminal is required.

In CK and KS power supplies, the zener reference for the current bridge is such a source. It delivers a +6.2V potential to Terminal 2 on the barrier strip which may be borrowed to supply the cancellation current. A 1 megohm resistor from Terminal 2 to the null junction (Terminal 12 on CK and KS models) will cause 6.2 microamperes of cancellation current to flow. By suitably adjusting this resistor, exact cancellation can be obtained.



A convenient way of determining when complete cancellation is achieved is to disconnect the regular programming voltage, or E_R, and observe the output voltmeter as the cancellation current is varied. If the load circuit is opened, this becomes a very sensitive test since the minutest current will tend to cause infinite voltage compliance across an open circuit.

When compensated, current regulation can be achieved down to virtual zero; 10-100 nanoamperes is a practicable limit. The maximum current is limited only by the ability of the programming source (the E_R substitute) to deliver current. Since this current must flow through the series resistor substituting for R_R it must not be so large as to cause heating in this resistor. For the larger values of current, the previously described sampling method of current regulation works well and should be used.

ABC power supplies lack the plus reference source but they can easily be compensated with the aid of a small battery and appropriate resistance. A 1.35V mercury cell would be an excellent choice.

VENTILATION

Both convection cooled and forced air cooled equipment are listed in this catalog. Forced air cooling is used in high power units to insure reliable performance over the specified temperature ranges. It is furthermore, a significant advantage where the equipment is to be stacked, as in an enclosed cabinet rack.

With the LATERAL (side to side) ventilation design used in all KEPCO forced-air cooled units, a cabinet rack installation may require nothing more than venting perforations in the cabinet to encourage natural convection. When other highly dissipative equipment is installed within the same enclosure, a cabinet venting fan may be indicated to reduce the interior temperature to safe limits. The air movement created by the power supply fan may often be adequate to accomplish this cooling.

RACK MOUNTING

Most models are equipped with front mounting panels designed to enable the unit to be mounted directly in a standard 19 inch rack or cabinet. The half-rack size bench models may be mounted with accessory rack adapters which are available to mount a single unit, or two units side by side. Modular power supplies may also be mounted in a variety of rack configurations. With the exception of the modular supplies and some vacuum-tube units, all models come fully encased, suitable for portable or bench use. See Accessory Pages 46 and 47.

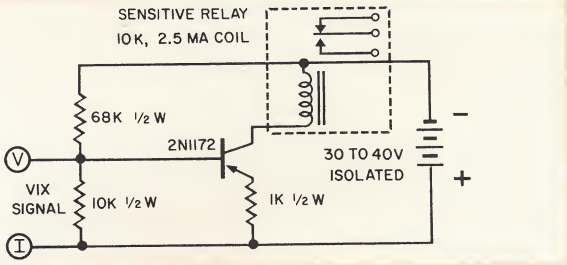
STORAGE

Irrespective of their rated operating temperature range, all Kepco Power Supplies may be stored under ambient temperature conditions that range from —40 degrees C as a lower limit to +85 degrees C for an upper limit. Under conditions of high humidity or condensation, suitable protective measures should be taken (vapor proof seals, etc.). If prolonged storage or operation under high moisture conditions is anticipated, Power Supplies can be ordered with full moisture and fungus proofing varnish (MFP) applied to all exposed and unprotected surfaces.

REMOTE VIX SIGNALLING

VIX equipped power supplies are provided with a pair of rear-panel pin jacks which make available the mode indicating signal for external use. The mode indicating voltage is a two condition signal: the "V" terminal is 8 volts positive with respect to the "I" terminal during voltage regulated operation and the "I" terminal is 8 volts positive with respect to the "V" terminal during current regulated operation. Polarity reversal occurs abruptly at the crossover point. The VIX control signal delivers up to 0.8 milliamperes, which is adequate to activate a sensitive relay through a single transistor amplifier. Figure 1 shows a typical circuit controlling a SPDT relay, whose contacts can operate remote indicators or machinery control equipment. Model VIX-1C is available as an accessory to actuate a SPDT relay on VIX command. See Page 43.

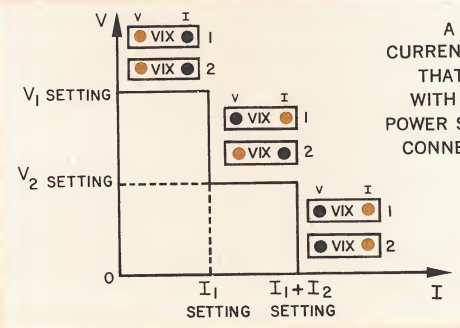
Figure 1



For given power supply output settings of V_X and I_X, the VIX signal polarity reversal occurs when the load resistance goes through the crossover resistance value $R_X = V_X/I_X$. A variable load going through the value R_X, can therefore be used to start or stop automated machinery or timing motors. This VIX polarity reversal can also be used to signal the conclusion of a battery or capacitor charging cycle, or to actuate a fault detection mechanism.

SERIES AND PARALLEL OPERATION OF VIX EQUIPPED POWER SUPPLIES

Power supplies equipped with VIX (voltage/current crossover mode indicators) are uniquely adapted to operate in series or parallel configurations without auxiliary or slaving connections. A VIX equipped power supply can be paralleled with a similar VIX power supply by simply connecting them in parallel. Series connection is equally simple, requiring only a pair of auxiliary shunt diodes across the output of each supply. The VIX lights, by indicating the operating mode of each supply, gives continuous information concerning the voltage/current characteristic of the load.



A TYPICAL VOLTAGE/CURRENT CHARACTERISTIC THAT CAN BE OBTAINED WITH TWO VIX EQUIPPED POWER SUPPLIES THAT ARE CONNECTED IN PARALLEL

NOMOGRAPH OF VOLTAGE DROP ACROSS LOAD SUPPLY LEADS
(as a function of wire size and load current)

THIS NOMOGRAPH CAN BE USED TO FIND:

Maximum current carrying capacity recommended for any standard wire size.*

1) With a straight edge, connect from the wire size on Scale 2 to the point "A" on Scale 3.
2) Read I_{max} on Scale 1.

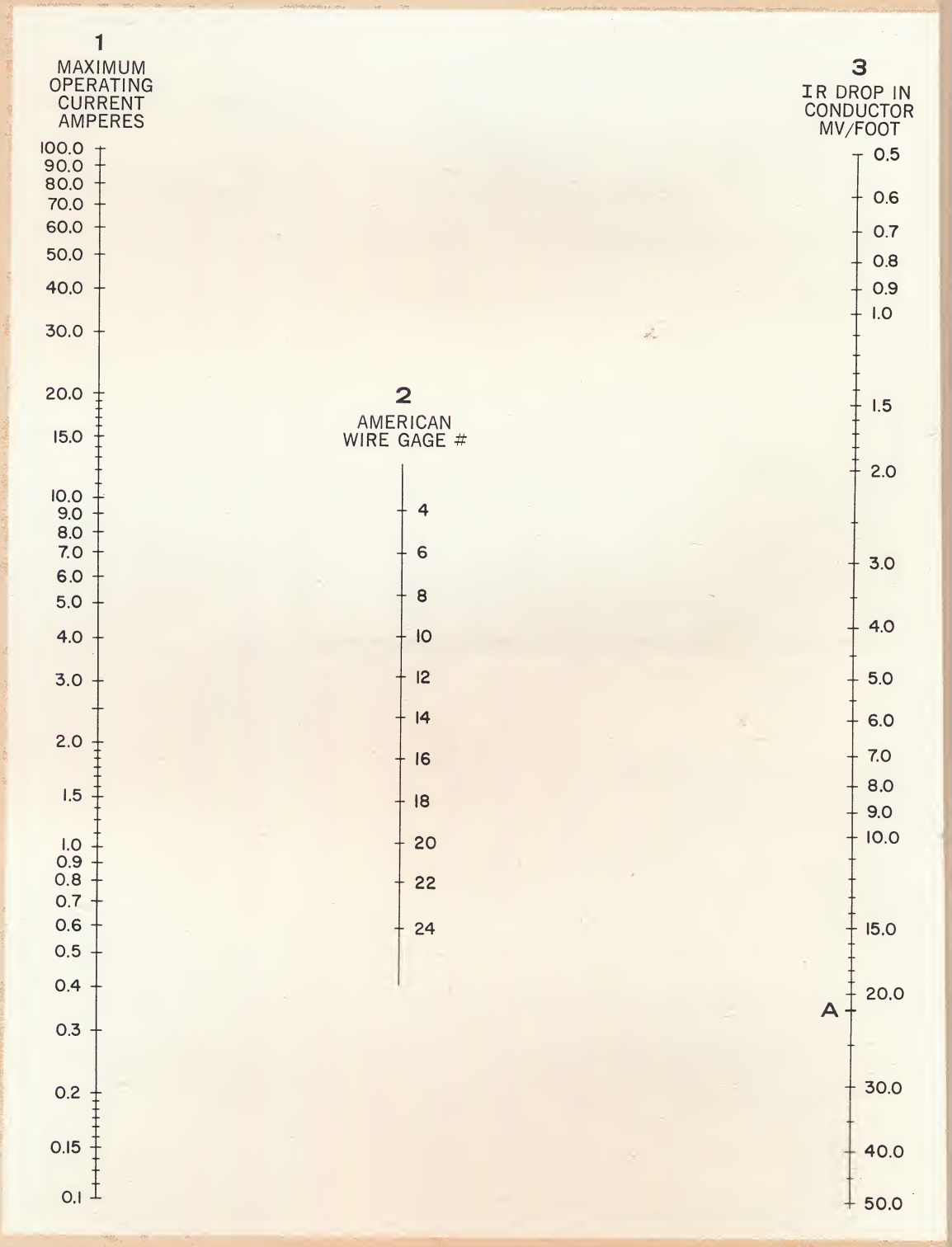
Voltage drop in millivolts per foot for known wire size and operating current.

1) With a straight edge, connect the known current on Scale 1 and the wire size on Scale 2.
2) Read voltage drop on Scale 3.

Wire size required for known operating current and known maximum tolerable voltage drop across supply leads.

1) Determine maximum tolerable drop in millivolts **per foot** of lead (sum of positive and negative leads).
2) Connect the value on Scale 3 (as determined in step 1) to the known current on Scale 1.
3) Read wire size on Scale 2.

**Based on an arbitrary minimum 500 circular mils per ampere. High-temperature class insulation will safely allow higher currents.*



NOTE: A voltage regulated Power Supply controls the voltage across its output terminals. Hence the wire conductors used to connect the load must be considered as part of the load. At high load currents the voltage drop across the supply leads may appreciably degrade regulation at the load. Kepco models equipped with the **remote error sensing** feature can automatically compensate for voltage drops of up to 500 mv across each load supply lead.

kepco

ABC

REGULATED DC SUPPLY

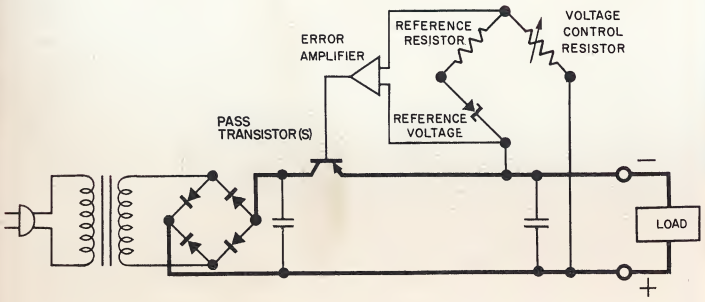
TRANSISTORIZED

ALL-TRANSISTOR GROUP

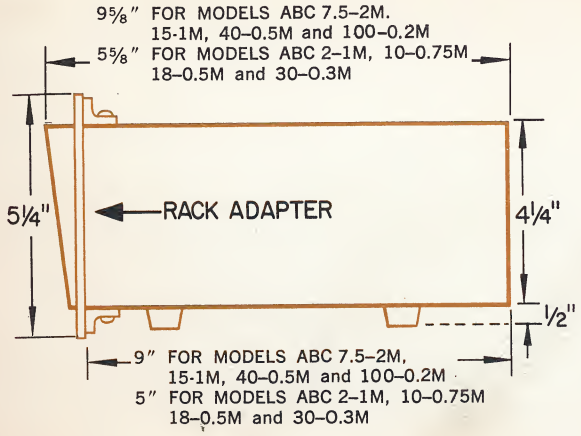
- *voltage/current regulation*
- *full range programming*
- *10-turn voltage control*
- *laboratory or systems use*
- *versatile, compact design*

0.05% REGULATION and STABILITY

MODEL	DC OUTPUT RANGE		RIPPLE RMS	OUTPUT IMPEDANCE OHMS MAX.			MAX. INPUT AMPS AT 125 V AC
	VOLTS	AMPS	MV	DC to 100 CPS	100 CPS to 1 KC	1 KC to 100 KC + μH	
ABC 2–1M	0–2	0–1	0.25	0.001	0.01	0.1 + 0.5	0.3
ABC 7.5–2M	0–7.5	0–2	0.25	0.002	0.01	0.05+ 0.5	0.5
ABC 10–0.75M	0–10	0–0.75	0.25	0.007	0.02	0.1 + 1	0.3
ABC 15–1M	0–15	0–1	0.25	0.008	0.01	0.05+ 0.5	0.5
ABC 18–0.5M	0–18	0–0.5	0.25	0.02	0.02	0.1 + 1	0.3
ABC 30–0.3M	0–30	0–0.3	0.25	0.05	0.02	0.1 + 1	0.3
ABC 40–0.5M	0–40	0–0.5	0.25	0.04	0.02	0.05+ 0.5	0.5
ABC 100–0.2M	0–100	0–0.2	0.25	0.25	0.05	0.05+1	0.5



All models are designed for continuous operation without derating under all specified line, load and temperature conditions.



SPECIFICATIONS, Voltage Regulation Mode

REGULATION: *Line:* Less than 0.05% or 1 mv output voltage change, whichever is greater, for 105-125V AC or 210-250V AC line variation, at any output voltage within the specified range.

Load: Less than 0.05% or 1 mv output voltage change, whichever is greater for *no load* to *full load* change at any output voltage within the specified range.

STABILITY: Output voltage varies less than 0.05% or 3 mv, whichever is greater, over a period of 8 hours after warmup. Measured at constant line voltage, load and ambient temperature.

TEMPERATURE COEFFICIENT: Output voltage changes less than 0.05% per °C.

RIPPLE: Less than 0.25 mv rms.

RECOVERY TIME: 50 microseconds.

OUTPUT IMPEDANCE: Specified for each model within the load frequency range shown in the table. Above 10 kc include the reactive impedance of the effective series inductance as indicated.

SPECIFICATIONS, Current Regulation Mode

External Sensing

OUTPUT RANGE: Current regulation from 1 ma to 100% of the maximum rated current.

COMPLIANCE: Voltage compliance range is zero to 100% of the maximum output voltage.

For any selected current value, the output voltage is automatically varied throughout the compliance range as required to regulate the output current through a variable load.

REGULATION: *Line:* For 105-125V AC or 210-250V AC line variations, output current changes less than 0.1% when the specified voltage sample is maintained across the external sensing resistor.

Load: For the maximum change in load resistance, within the rated compliance range, output current changes less than 0.5% when the specified voltage sample is maintained across the external sensing resistor.

The sensing resistor is chosen to produce a one volt drop at the maximum operating current. A separate control is used externally to provide high resolution current adjustability.

STABILITY: Output current varies less than 0.1% or 1 ma, whichever is greater, over a period of 8 hours after warmup. Measured at constant line voltage, load and ambient temperature.

TEMPERATURE COEFFICIENT: Output current changes less than 0.1% per °C.

RIPPLE: Less than 0.1% of maximum current, rms.

SPECIFICATIONS, General

INPUT REQUIREMENTS: 105-125 or 210-250V AC, 50-440 cps single phase.

AMBIENT OPERATING TEMPERATURE: −20°C to +50°C maximum.

STORAGE TEMPERATURE: −40°C to +85°C maximum.

Data subject to change without notice
PATENT NOTICE: Applicable Patent Nos. will be supplied on request.

kepco

ISOLATION VOLTAGE: A maximum of 500 volts can be connected between the chassis and either output terminal.

SPECIFICATIONS, Performance

CONTROLS: Continuously adjustable 10-turn voltage control permits output settings from zero to the maximum voltage. Resolution: 0.05% of maximum output.

PROGRAMMING: Special terminals provide for remote resistive programming of voltage or current at 1000 ohms per volt. Programming terminals are also provided for programming by means of remotely located voltage or current signals.

CURRENT LIMIT CONTROL: A single turn control provides adjustable current limiting from 25% to 150% of rated full-load current.

SHORT CIRCUIT PROTECTION: Unique current limiting circuitry permits continuous operation into a short circuit without the aid of fuses, circuit breakers or relays. Output returns instantly to the operating voltage when the overload is removed.

REMOTE ERROR SENSING: Error sensing terminals enable specified voltage regulation to be maintained directly at the load by compensating for voltage drops up to 0.5 volts across each load supply lead.

SERIES/PARALLEL OPERATION: Current limiting capability permits series or parallel operation. In parallel, units operate automatically to share a load by means of the current limiting feature.

COOLING: Heat removal is by natural convection, without blowers.

OVERSHOOT: No output voltage overshoot from turn-on, turn-off or power failure for output settings above 25% of max. rated voltage. Below 25%, output overshoot is a function of load and is negligible for loads in excess of 10%.

SPECIFICATIONS, Physical

METERS: Model numbers in table include 2½" combination voltmeter, ammeter; 2% full scale accuracy. To specify an unmetered unit, delete the suffix "M" from the model no., e.g., ABC 40-0.5, for unit without meters.

ON FRONT PANEL: DC output and ground (5-way) terminals. 10-turn voltage control, short circuit current adjusting control, AC on-off switch, pilot light and fuse. Volt/amp meter and meter selector switch provided on metered units.

On Rear of Chassis: Barrier strip terminations are provided for DC output and ground connections, resistive or voltage programming, current regulator connections, and remote error sensing. Access is provided for the voltage calibration control. Output terminals are isolated from the chassis, either positive or negative terminal may be grounded.

DIMENSIONS: 4¼" H x 8$^{5}/_{32}$" W. See outline drawing for the depth dimensions of each model.

STANDARD FINISH: Panel etched aluminum — brushed and coated. Case, gray hammertone (special finishes to order).

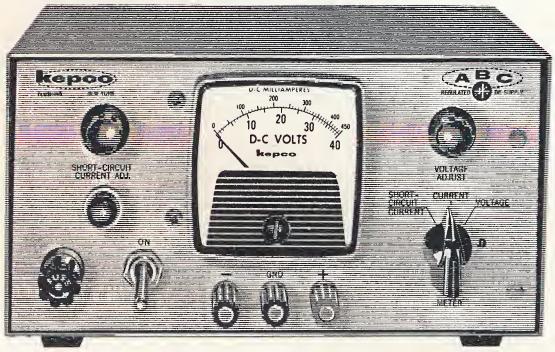
RACK MOUNTING: Rack mounting adapters (5¼" high x 19" wide) available for single or dual rack mounting:
Model RA-5 for mounting single unit.
Model RA-4 for mounting two units side by side.
See Accessory Page 47 for outline dimensional drawings of rack adapters.

131-38 SANFORD AVENUE • FLUSHING, N.Y. 11352 • Phone: (212) IN 1-7000
TWX #212-539-6623 • Cable Address: KEPCOPOWER, NEWYORK

TRANSISTORIZED

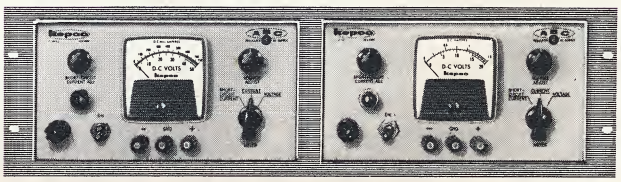
kepco ABC REGULATED DC SUPPLY

ALL-TRANSISTOR GROUP



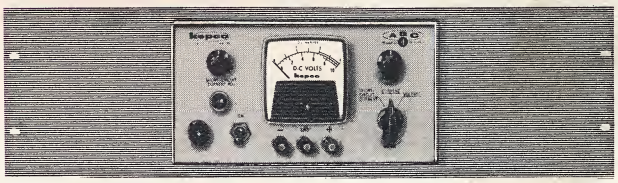
Model ABC 30-0.3M

ABC 40-0.5M ABC 15-1M

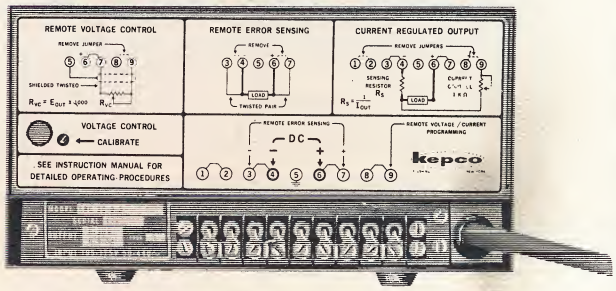


TYPICAL ASSEMBLY IN MODEL RA-4 RACK ADAPTER

ABC 7.5-2M



TYPICAL ASSEMBLY IN MODEL RA-5 RACK ADAPTER



TYPICAL REAR VIEW SHOWING ACCESSIBLE TERMINAL BLOCK WITH SIMPLIFIED CONNECTION GUIDE.

kepco ABC REGULATED DC SUPPLY

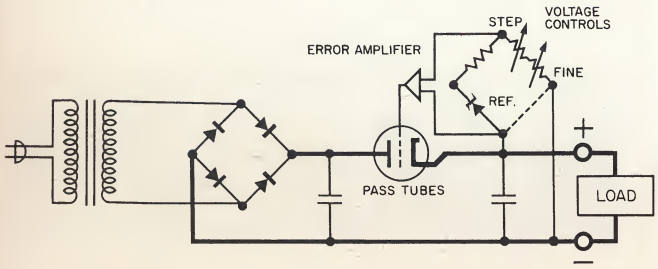
HYBRID

HYBRID GROUP

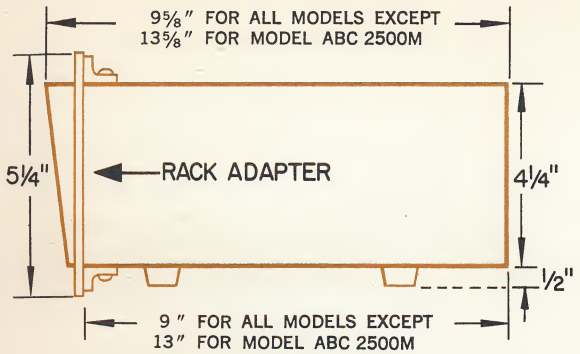
- *voltage/current regulation*
- *full range programming*
- *10-turn voltage control*
- *laboratory or systems use*
- *versatile, compact design*

0.05% REGULATION and STABILITY

MODEL	DC OUTPUT RANGE VOLTS	DC OUTPUT RANGE MA.	RIPPLE RMS MV	OUTPUT IMPEDANCE OHMS MAX. DC to 100 CPS	100 CPS to 1 KC	1 KC to 100 KC + μH	MAX. INPUT AMPS At 125 V AC
ABC 200M	0–200	0–100	0.5	1	0.5	2.0 + 2.0	0.5
ABC 425M	0–425	0–50	0.5	4	0.5	2.0 + 2.0	0.5
ABC 1000M	0–1000	0–20	1.0	25	1.0	2.0 +10.0	0.5
ABC 1500M	0–1500	0–10	1.0	75	1.0	2.0 +10.0	0.3
ABC 2500M	0–2500	0–2	1.0	625	1.0	2.0 +10.0	0.3



All models are designed for continuous operation without derating under all specified line, load and temperature conditions.



Data subject to change without notice

PATENT NOTICE: Applicable Patent Nos. will be supplied on request.

SPECIFICATIONS, Voltage Regulation Mode

REGULATION: *Line:* Less than 0.05% or 5 mv output voltage change, whichever is greater, for 105-125V AC or 210-250V AC line variation, at any output voltage within the specified range.

Load: Less than 0.05% or 5 mv output voltage change, whichever is greater, for *no load* to *full load* change at any output voltage within the specified range.

STABILITY: Output voltage varies less than 0.05% or 50 mv, whichever is greater, over a period of 8 hours after warmup. Measured at constant line voltage, load and ambient temperature.

TEMPERATURE COEFFICIENT: Output voltage changes less than 0.05% per °C.

RIPPLE: See table for maximum specification applicable to each model.

RECOVERY TIME: 50 microseconds.

OUTPUT IMPEDANCE: Specified for each model within the load frequency range shown in the table. Above 10 kc include the reactive impedance of the effective series inductance as indicated.

SPECIFICATIONS, Current Regulation Mode

External Sensing

OUTPUT RANGE: Current regulation from 1 ma to 100% of the maximum rated current.

COMPLIANCE: Voltage compliance range is zero to 100% of the maximum output voltage.

For any selected current value, the output voltage is automatically varied throughout the compliance range as required to regulate the output current through a variable load.

REGULATION: *Line:* For 105-125V AC or 210-250V AC line variations, output current changes less than 0.1% when the specified voltage sample is maintained across the external sensing resistor.

Load: For the maximum change in load resistance, within the rated compliance range, output current changes less than 0.1% when the specified voltage sample is maintained across the external sensing resistor.

The sensing resistor is chosen to produce a 10 volt drop at the maximum operating current. A separate control is used externally to provide high resolution current adjustability.

STABILITY: Output current varies less than 0.1% or 10μa, whichever is greater, over a period of 8 hours after warmup. Measured at constant line voltage, load and ambient temperature.

TEMPERATURE COEFFICIENT: Output current changes less than 0.1% per °C.

RIPPLE: Less than 0.1% of maximum current, rms.

SPECIFICATIONS, General

INPUT REQUIREMENTS: 105-125 or 210-250V AC, 50-440 cps single phase.

AMBIENT OPERATING TEMPERATURE: −20°C to +55°C maximum.

STORAGE TEMPERATURE: −40°C to +85°C maximum.

ISOLATION VOLTAGE: A maximum of 1000 volts can be connected between the chassis and either output terminal.

AUXILIARY OUTPUT: 6.5 V AC, unregulated, at 2 amperes available at the rear terminals of Models ABC 200M and ABC 425M.

SPECIFICATIONS, Performance

CONTROLS: Continuously adjustable voltage control permits output settings from zero to the maximum voltage. The

voltage control on Models ABC 200M and ABC 425M is a single 10-turn control; resolution: 0.05% of maximum output. The voltage control for Models ABC 1000M, ABC 1500M and ABC 2500M consists of a 10-position step switch with a 10-turn control interpolating between switch positions; resolution: 0.005% of maximum output.

PROGRAMMING: Special terminals provide for remote resistive programming of voltage or current at 1000 ohms per volt. Programming terminals are also provided for programming by means of remotely located voltage or current signals.

CURRENT LIMIT CONTROL: A single control provides adjustable current limiting from 25% to 150% of rated full-load current on Models ABC 200M and ABC 425M. Fixed current limiting, set to approximately 150% of rated maximum current is provided on Models ABC 1000M, ABC 1500M and ABC 2500M.

SHORT CIRCUIT PROTECTION: Unique current limiting circuitry permits continuous operation into a short circuit without the aid of fuses, circuit breakers or relays. Output returns instantly to the operating voltage when the overload is removed.

SERIES/PARALLEL OPERATION: Current limiting capability permits series or parallel operation. In parallel, units operate automatically to share a load by means of the current limiting feature. Series operation is limited to the 1000 volts of isolation.

HYBRID CIRCUIT: Unique design achieves high efficiency and reliability by using transistorized reference and amplification circuits for optimum regulation, stability and long life. Vacuum tubes are used for series pass elements for reliable high voltage operation.

COOLING: Heat removal is by natural convection.

OVERSHOOT: No output voltage overshoot from turn-on, turn-off or power failure for output settings above 25% of max. rated voltage. Below 25%, output overshoot is a function of load and is negligible for loads in excess of 10%.

SPECIFICATIONS, Physical

METERS: Model numbers in table include 2½" combination voltmeter, ammeter; 2% full scale accuracy. To specify an unmetered unit, delete the suffix "M" from the model no., e.g., ABC 200, for unit without meters. Models ABC 1000M, ABC 1500M and ABC 2500M include a voltmeter only.

TERMINALS AND CONTROLS: *On Front Panel:* DC output and ground (5-way) terminals. DC voltage control, AC on-off switch, pilot light and fuse. A volt/amp meter, meter selector switch and short circuit current adjusting control are provided on all models except ABC 1000M, ABC 1500M and ABC 2500M which contain a voltmeter only, plus the 10-position voltage step switch.

On Rear of Chassis: Barrier strip terminations are provided for DC output and ground connections, resistive or voltage programming and current regulator connections. Access is provided for the voltage calibration control. Output terminals are isolated from the chassis, either positive or negative terminal may be grounded.

DIMENSIONS: 4¼" H x 8$^{5}/_{32}$" W. See outline drawing for the depth dimensions of each model.

STANDARD FINISH: Panel, etched aluminum — brushed and coated. Case, gray hammertone (special finishes to order).

RACK MOUNTING: Rack mounting adapters (5¼" high x 19" wide) available for single or dual rack mounting:
Model RA-5 for mounting single unit.
Model RA-4 for mounting two units side by side.

See Accessory Page 47 for outline dimensional drawings of rack adapters.

HYBRID

kepco ABC REGULATED DC SUPPLY

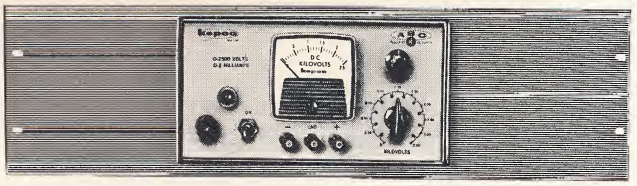
HYBRID GROUP

Model ABC 1500M

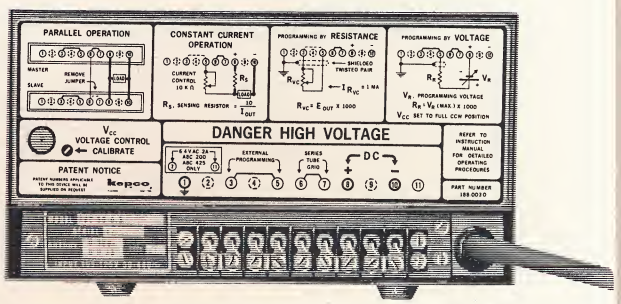
ABC 425M ABC 1500M

TYPICAL ASSEMBLY IN MODEL RA-4 RACK ADAPTER

ABC 2500M



TYPICAL ASSEMBLY IN MODEL RA-5 RACK ADAPTER



TYPICAL REAR VIEW SHOWING ACCESSIBLE TERMINAL BLOCK WITH SIMPLIFIED CONNECTION GUIDE.

kepco

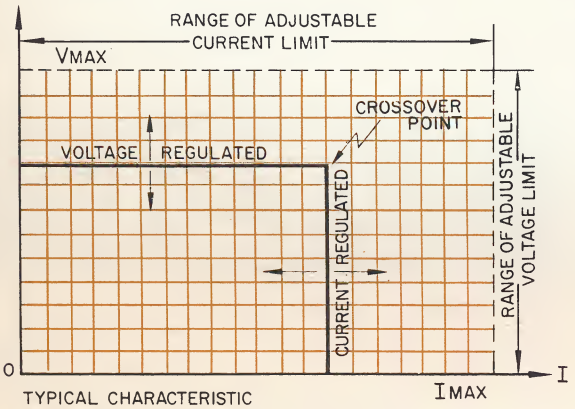
CK REGULATED DC SUPPLY GROUP

TRANSISTORIZED

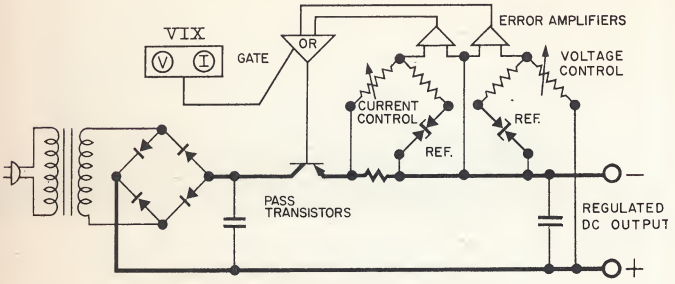
- *VIX mode indicators*
- *automatic voltage/current crossover*
- *full range programming*
- *10-turn voltage and current controls*

0.01% REGULATION and STABILITY

MODEL	DC OUTPUT RANGE		OUTPUT IMPEDANCE OHMS MAX.			MAX. INPUT AMPS
	VOLTS	AMPS	DC to 100 CPS	100 CPS to 1 KC	1 KC to 100 KC + μH	At 125 V AC
CK 2–8M	0–2	0–8	0.065×10^{-3}	0.01	0.05+0.5	1
CK 8–5M	0–8	0–5	0.16×10^{-3}	0.01	0.05+0.5	1.2
CK 18–3M	0–18	0–3	0.6×10^{-3}	0.01	0.05+0.5	1.3
CK 36–1.5M	0–36	0–1.5	2.4×10^{-3}	0.02	0.08+0.8	1.5
CK 40–0.8M	0–40	0–0.8	5×10^{-3}	0.02	0.08+0.8	1
CK 60–0.5M	0–60	0–0.5	12×10^{-3}	0.02	0.08+0.8	1



TYPICAL CHARACTERISTIC
AUTOMATIC VOLTAGE/CURRENT CROSSOVER



All models are designed for continuous operation without derating under all specified line, load and temperature conditions.

Data subject to change without notice. PATENT NOTICE: Applicable Patent Nos. will be supplied on request.

SPECIFICATIONS, Voltage Regulation Mode

REGULATION: *Line:* Less than 0.01% output voltage change for 105-125V AC or 210-250V AC line variation, at any output voltage within the specified range.
Load: Less than 0.01% or 0.5 mv output voltage change, whichever is greater for *no load* to *full load* change at any output voltage within the specified range. The 0.5 mv specification governs throughout the entire range of Model CK 2-8M.

STABILITY: Output voltage varies less than 0.01% or 2 mv, whichever is greater, over a period of 8 hours after warmup. Measured at constant line voltage, load and ambient temperature.

TEMPERATURE COEFFICIENT: Output voltage changes less than 0.01% per °C.

RIPPLE: Less than 0.5 mv rms.

RECOVERY TIME: 50 microseconds.

OUTPUT IMPEDANCE: Specified for each model within the load frequency range shown in the table. Above 10 kc include the reactive impedance of the effective series inductance as indicated.

SPECIFICATIONS, Current Regulation Mode

OUTPUT RANGE, Internal Sensing: Current regulation from less than 0.2% to 100% of the maximum specified current. Automatic crossover to voltage limiting provided.
External Sensing: Current regulation from 1 ma to 100% of the maximum rated current.

COMPLIANCE, Internal Sensing: Voltage compliance range is zero to the voltage control setting. The setting is adjustable, zero to 100% of the rated voltage range.
External Sensing: Voltage compliance range is zero to 100% of the maximum output voltage.
For any selected current value, the output voltage is automatically varied throughout the compliance range as required to regulate the output current through a variable load.

REGULATION, Internal Sensing: *Line:* Less than 0.01% or 0.2 ma, whichever is greater, output current change for 105-125V AC or 210-250V AC line variation at any output current within the specified range. For models rated at 2 amperes or less output current, the 0.2 ma regulation specification governs.
Load: Less than 0.01% or 0.2 ma, whichever is greater, output current change for the maximum change in load resistance within the rated compliance range. For models rated at 2 amperes or less output current, the 0.2 ma regulation specification governs.

REGULATION, External Sensing: *Line:* For 105-125V AC or 210-250V AC line variations, output current changes less than 0.01% when the specified voltage sample is maintained across the external sensing resistor.
Load: For the maximum change in load resistance, within the rated compliance range, output current changes less than 0.01% when the specified voltage sample is maintained across the external sensing resistor.
The sensing resistor is chosen to produce a one volt drop at the maximum operating current. A separate control is used externally to provide high resolution current adjustability.

STABILITY: Output current varies less than 0.05% or 1 ma, whichever is greater, over a period of 8 hours after warmup. Measured at constant line voltage, load and ambient temperature.

TEMPERATURE COEFFICIENT: Output current changes less than 0.05% per °C.

RIPPLE: Less than 0.05% of output current setting or 0.01% of maximum current rating, whichever is greater, rms.

SPECIFICATIONS, General

INPUT REQUIREMENTS: 105-125 or 210-250V AC, 50-65 cps single phase. Units available for 400 cps input on special order.

AMBIENT OPERATING TEMPERATURE: −20°C to +50°C max.

STORAGE TEMPERATURE: −40°C to +85°C maximum.

ISOLATION VOLTAGE: A maximum of 500 volts can be connected between the chassis and either output terminal.

SPECIFICATIONS, Performance

CONTROLS: Continuously adjustable 10-turn voltage and current controls permit output settings from zero to the maximum voltage and current. Resolution: 0.05% of maximum output.

PROGRAMMING: Special terminals provide for remote resistive programming of voltage or current at 1000 ohms per volt. Programming terminals are also provided for programming by means of remotely located voltage or current signals.

AUTOMATIC CROSSOVER: The automatic crossover circuit switches the operating mode of the power supply automatically from constant voltage to constant current or vice versa depending on the load relationship to the panel voltage and current adjustments. In the voltage regulation mode, the current control serves as a current limit adjustment while in current regulating mode, the voltage control serves as a voltage limiting adjustment.

VIX INDICATORS: The power supply's operating mode is indicated by a pair of front-panel signal lamps. One lamp is lighted during voltage regulated operation, the other during current regulated operation (internal current sensing only). Crossover from one mode to the other is signalled by the extinction of one lamp and the lighting of the other.

VIX REMOTE SIGNAL: A pair of rear-panel pin jacks, labelled "V" and "I" provide external access to the VIX signal. Pin V is 8 volts positive with respect to pin I during voltage regulated operation. Pin I is 8 volts positive with respect to Pin V during current regulated operation. Maximum loading: 10 K ohms; isolated from ground and the output terminals of the power supply. Crossover from one mode to the other is signalled by an abrupt polarity reversal.

REMOTE ERROR SENSING: Error sensing terminals enable specified voltage regulation to be maintained directly at the load by compensating for voltage drops up to 0.5 volts across each load supply lead.

SERIES/PARALLEL OPERATION: Automatic crossover capability permits series or parallel operation in either voltage or current regulating modes. Units operate automatically to share a load by means of their automatic crossover feature. Connections are also provided for operation in master/slave configuration.

COOLING: Lateral circulation by blowers insures efficient heat transfer; permits stacking of multiple units without overheating.

OVERSHOOT: No output voltage overshoot from turn-on, turn-off or power failure for output settings above 25% of max. rated voltage. Below 25%, output overshoot is a function of load and is negligible for loads in excess of 10%.

SPECIFICATIONS, Physical

METERS: Model numbers in table include 2½", rectangular voltmeter and ammeter; 2% full scale accuracy. To specify an unmetered unit, delete the suffix "M" from the model no. e.g., CK 18-3, for unit without meters.

TERMINALS AND CONTROLS: *On Front Panel:* AC on-off switch, fuse and two VIX mode lamps, 10-turn voltage control, 10-turn current control, DC output and ground (5-way) terminals.

On Rear of Chassis: Two VIX remote signal 0.08" pin jacks. Barrier strip connections for DC output and ground terminals, remote error sensing, voltage and current programming by remote resistance and/or voltage, master-slave parallel operation, external current sensing. Output terminals are isolated from the chassis, either positive or negative terminal may be grounded.

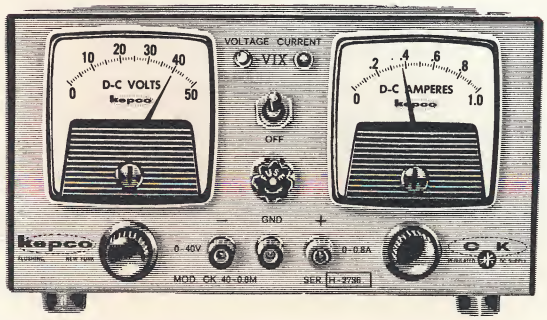
DIMENSIONS: 4¼"H x 8$\frac{5}{32}$"W x 13"D (behind rack adapter) 13⅜"D overall.

FINISH: Panel, etched aluminum — brushed and coated. Case, gray hammertone (special finishes to order).

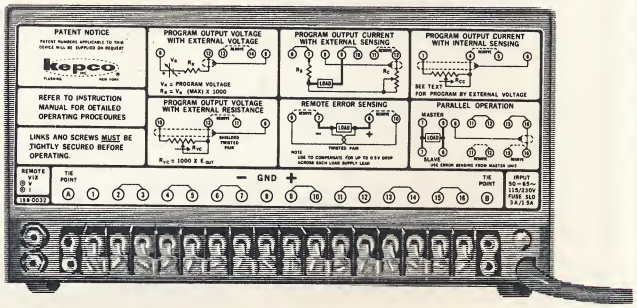
MOUNTING: Rack mounting adapters (5¼" high x 19" wide) available for single or dual rack mounting:
Model RA 5 for mounting single unit.
Model RA 4 for mounting two units side by side.
See Accessory Page 47 for outline dimensional drawings of rack adapters.

TRANSISTORIZED

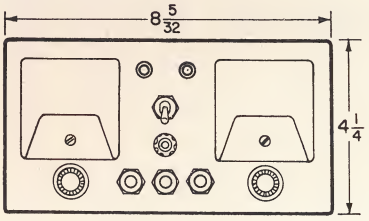
kepco CK REGULATED DC SUPPLY GROUP



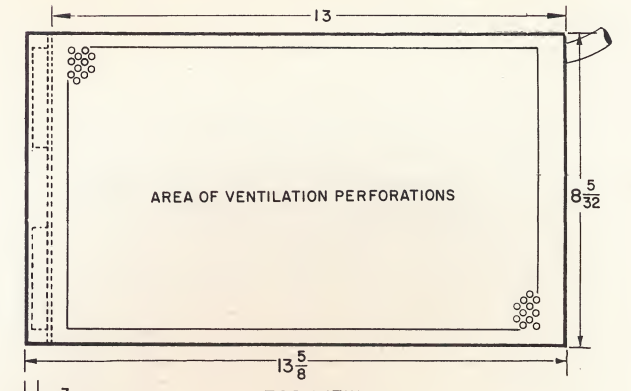
Model CK 40-0.8M



TYPICAL REAR VIEW SHOWING ACCESSIBLE TERMINAL BLOCK WITH SIMPLIFIED CONNECTION GUIDE



FRONT VIEW



TOP VIEW

SIDE VIEW

kepco

H B

REGULATED DC SUPPLY

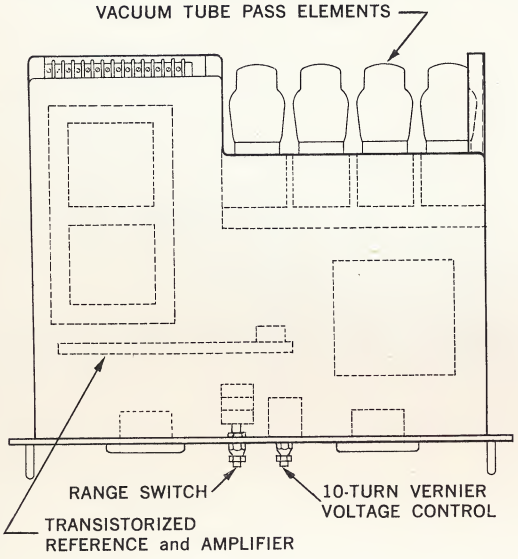
GROUP

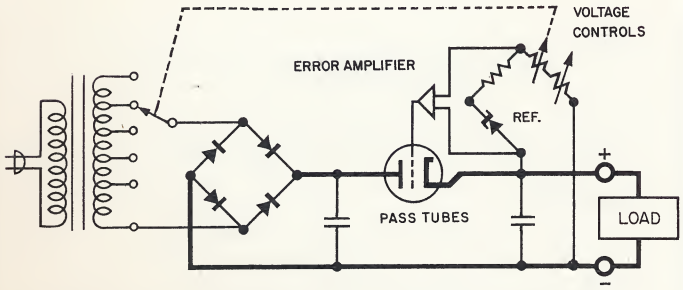
HYBRID

- *unique hybrid regulator*
- *10-turn vernier voltage control*
- *full range regulation*
- *full range programming*
- *voltage/current regulation*

0.01% REGULATION and STABILITY

MODEL	DC OUTPUT RANGE		OUTPUT IMPEDANCE OHMS MAX.			AUX. OUTPUT 6.5VAC Unregulated	MAX. INPUT AMPS AT 125 V AC
	VOLTS	MA.	DC to 100 CPS	100 CPS to 1 KC	1 KC to 100 KC + μH		
HB 2AM	0–325	0–200	0.2	0.08	0.2+0.5	EACH SUPPLY HAS TWO 6 AMPERE OUTPUTS	2.0
HB 4AM	0–325	0–400	0.1	0.08	0.2+0.5		3.0
HB 6AM	0–325	0–600	0.06	0.08	0.2+0.5		5.0
HB 8AM	0–325	0–800	0.05	0.08	0.2+1.0		5.5
HB 250M	0–250	0–1000	0.025	0.08	0.2+0.5		8.0
HB 525M	0–525	0–500	0.1	0.08	0.2+0.5		8.0





All models are designed for continuous operation without derating under all specified line, load and temperature conditions.

SPECIFICATIONS, Voltage Regulation Mode

REGULATION: *Line:* Less than 0.01% output voltage change for 105-125V AC or 210-250 V AC line variation, at any output voltage within the specified range.

Load: Less than 0.01% or 2 mv output voltage change, whichever is greater, for *no load* to *full load* change at any output voltage within the specified range.

STABILITY: Output voltage varies less than 0.01% or 2 mv, whichever is greater, over a period of 8 hours after warmup. Measured at constant line voltage, load and ambient temperature.

TEMPERATURE COEFFICIENT: Output voltage changes less than 0.01% per °C.

RIPPLE: Less than 1 millivolt, rms.

RECOVERY TIME: 50 microseconds.

OUTPUT IMPEDANCE: Specified for each model within the load frequency range shown in the table. Above 10 kc include the reactive impedance of the effective series inductance as indicated.

SPECIFICATIONS, Current Regulation Mode

External Sensing

OUTPUT RANGE: Current regulation from 10 ma to 100% of the maximum rated current.

COMPLIANCE: Voltage compliance equals the span of one band switch position anywhere in the range from zero to 100% of the maximum output voltage.

For any selected current value, the output voltage is automatically varied throughout the compliance range as required to regulate the output current through a variable load. The compliance voltage range can be increased to the full output voltage range when the output current is derated in accordance with the load current derating graph. The range switch sets the maximum voltage; should the load require an output voltage below the lower limit of the selected band, output current must be derated in accordance with the graph.

REGULATION: *Line:* For 105-125V AC or 210-250V AC line variations, output current changes less than 0.01% when the specified voltage sample is maintained across the external sensing resistor.

Load: For the maximum change in load resistance, within the rated compliance range, output current changes less than 0.01% when the specified voltage sample is maintained across the external sensing resistor.

The sensing resistor is chosen to produce a 10 volt drop at the maximum operating current. A separate control is used externally to provide high resolution current adjustability.

STABILITY: Output current varies less than 0.05% or 0.2 ma, whichever is greater, over a period of 8 hours after warmup. Measured at constant line voltage, load and ambient temperature.

TEMPERATURE COEFFICIENT: Output current changes less than 0.05% per °C.

RIPPLE: Less than 0.01% of maximum current, rms.

SPECIFICATIONS, General

INPUT REQUIREMENTS: 105-125 or 210-250V AC, 50-440 cps single phase.

Data subject to change without notice
PATENT NOTICE: Applicable Patent Nos. will be supplied on request.

kepco

AMBIENT OPERATING TEMPERATURE: −20°C to +55°C maximum.

STORAGE TEMPERATURE: −40°C to +85°C maximum.

ISOLATION VOLTAGE: A maximum of 600 volts can be connected between the chassis and either output terminal.

AC OUTPUT: Two 6.5V AC outputs, unregulated at 6 amperes each. Series for 13V AC-CT., at 6 amperes ; parallel for 6.5V AC at 12 amperes.

SPECIFICATIONS, Performance

VOLTAGE RANGE SWITCH: Provides step output settings in five discreet voltage bands. The range switch divides the output into five approximately equal segments.

FINE CONTROL: A 10-turn control interpolates between steps of the band switch. Resolution: 0.02% of maximum output voltage.

PROGRAMMING: Special terminals provide for remote resistive programming of voltage or current at 100 ohms per volt.

REMOTE ERROR SENSING: Model HB 250M and Model HB 525M include error sensing terminals to enable the specified voltage regulation to be maintained directly at the load by compensating for voltage drops up to 0.5 volts across each load supply lead.

HYBRID CIRCUIT: Unique design achieves high efficiency and reliability by using transistorized reference and amplification circuits for optimum regulation, stability and long life. Vacuum tubes are used for series pass elements for reliable high voltage operation.

COOLING: Heat removal is by natural convection. Pass tubes are physically remote from the sensitive comparison amplifier and are exposed at the rear for efficient heat transfer.

OVERSHOOT: No output voltage overshoot from turn-on, turn-off or power failure for output settings above 25% of max. rated voltage. Below 25%, output overshoot is a function of load and is negligible for loads in excess of 10%.

SPECIFICATIONS, Physical

METERS: Model numbers in table include 2½" rectangular voltmeter and ammeter; 2% full scale accuracy. To specify an unmetered unit, delete the suffix "M" from the model no., e.g., HB 2A, for unit without meters.

TERMINALS AND CONTROLS: *On Front Panel:* DC output and ground (5-way terminals), 5-position range switch and fine control (slotted shafts with locking devices), AC on-off switch, fuse and pilot light, DC on-off switch, fuse and pilot light.

On Rear of Chassis: Multi-terminal barrier strip contains DC output and ground, remote DC on-off, remote voltage control, program to zero and current regulator connections. Models HB 250M and HB 525M have remote error sensing terminals and provision for programming by means of remote voltage or current signals. All units have two 6.5V AC output terminals rated 6 amperes each. All output terminals are isolated from the chassis, either positive or negative output may be grounded.

DIMENSIONS: Standard EIA rack dimensions, 3½" H x 19" W x 14⅜" D (behind front panel).

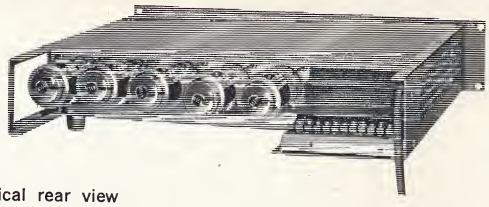
STANDARD FINISH: Gray hammertone (special finishes to order).

131-38 SANFORD AVENUE • FLUSHING, N.Y. 11352 • Phone: (212) IN 1-7000
TWX #212-539-6623 • Cable Address: KEPCOPOWER, NEWYORK

HYBRID

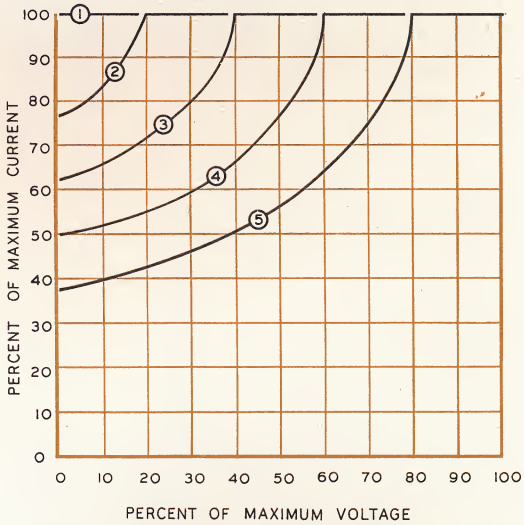
kepco
HB
REGULATED DC SUPPLY
GROUP

Model HB 6AM



Typical rear view

LOAD CURRENT DERATING GRAPH



This graph is provided to help compute the over-ranging capabilities of HB Power Supplies when externally programmed outside of the normal range of the voltage band switch. The graph is particularly useful for determining the voltage compliance range of the power supplies in their constant current mode of operation. To use the graph, plot the desired current as a horizontal line; the intercept that this line makes with each numbered locus defines the minimum output voltage permissible for that particular range switch position. For example: with Model HB 4AM operating in current regulator mode at 60% of rated current, the voltage compliance limits are 30% to 80% when the voltage range switch is in position (4). This corresponds to operation at 240 ma in band position 4 with 160 volts of compliance between 100 V DC and 260 V DC.

kepco

KO

REGULATED DC SUPPLY

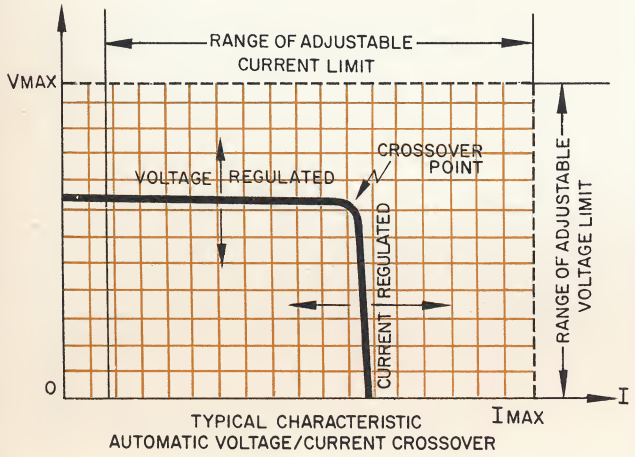
TRANSISTORIZED

GROUP

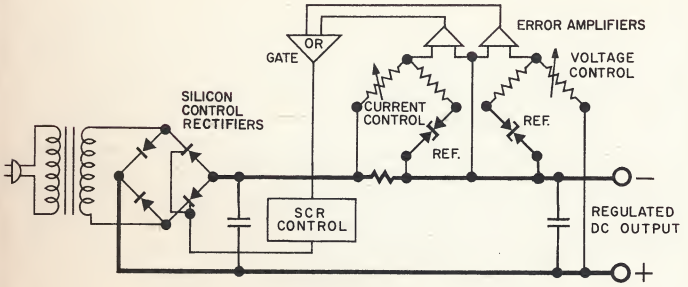
- *automatic voltage/current crossover*
- *full range programming*
- *high current*
- *10-turn voltage and current controls*

1% REGULATION and STABILITY

MODEL	DC OUTPUT RANGE		RIPPLE RMS	OUTPUT IMPEDANCE OHMS MAX.		MAX. INPUT At 125V AC	
	VOLTS	AMPS	% MV	1 KC to 10 KC	10 KC to 100 KC + μH	AMPS	WATTS
KO 12–100M	**0–12**	**0–100**	0.5 or 30	0.02	0.04+0.5	24	1800
KO 25–50M	**0–25**	**0–50**	0.5 or 40	0.02	0.04+0.5	24	1800
KO 45–30M	**0–45**	**0–30**	0.3 or 20	0.02	0.04+0.5	24	1800
KO 70–20M	**0–70**	**0–20**	0.3 or 20	0.02	0.04+0.5	24	1800



TYPICAL CHARACTERISTIC
AUTOMATIC VOLTAGE/CURRENT CROSSOVER



All models are designed for continuous operation without derating under all specified line, load and temperature conditions.

SPECIFICATIONS, Voltage Regulation Mode

REGULATION: *Line:* Less than 1% output voltage change for 105-125V AC or 210-250V AC line variation, at any output voltage within the specified range.

Load: Less than 1% or 20 mv output voltage change, whichever is greater, for *no load* to *full load* change at any output voltage within the specified range.

STABILITY: Output voltage varies less than 1% or 50 mv, whichever is greater, over a period of 8 hours after warmup. Measured at constant line voltage, load and ambient temperature.

TEMPERATURE COEFFICIENT: Output voltage changes less than 0.1% per °C.

RIPPLE: See table for maximum specification applicable to each model.

RECOVERY TIME: 500 milliseconds for 0-100% step load-on change or 100%-10% step load-off change.

OUTPUT IMPEDANCE: Specified for each model within the load frequency range shown in the table. Below 1000 cps, impedance is a function of load current and is determined by reference to the load regulation specification. Impedance is the slope ΔE/ΔI. Above 10 kc include the reactive impedance of the effective series inductance as indicated.

SPECIFICATIONS, Current Regulation Mode

Internal Sensing

OUTPUT RANGE: Current regulation from less than 10% to 100% of the maximum specified current. Automatic crossover to voltage limiting provided.

COMPLIANCE: Voltage compliance range is zero to the voltage control setting. The setting is adjustable, zero to 100% of the rated voltage range.

For any selected current value, the output voltage is automatically varied throughout the compliance range as required to regulate the output current through a variable oad.

REGULATION: *Line:* Less than 2% or 200 ma, whichever is greater, output current change for 105-125V AC or 210-250V AC line variation at any output current within the specified range.

Load: Less than 2% or 200 ma, whichever is greater, output current change for the maximum change in load resistance within the rated compliance range.

STABILITY: Output current varies less than 2% or 200 ma, whichever is greater, over a period of 8 hours after warmup. Measured at constant line voltage, load and ambient temperature.

TEMPERATURE COEFFICIENT: Output current changes less than 0.5% per °C.

RIPPLE: Less than 0.5% of maximum current, rms.

SPECIFICATIONS, General

INPUT REQUIREMENTS: 105-125 or 210-250V AC, 50-65 cps, single phase. Input taps are also provided for operation from 104 ±9V AC and 208 ±18V AC.

Data subject to change without notice
PATENT NOTICE: Applicable Patent Nos. will be supplied on request.

kepco

AMBIENT OPERATING TEMPERATURE: −20°C to +50°C maximum.

STORAGE TEMPERATURE: −40°C to +85°C maximum.

ISOLATION VOLTAGE: A maximum of 500 volts can be connected between the chassis and either output terminal.

SPECIFICATIONS, Performance

CONTROLS: Continuously adjustable 10-turn voltage and current controls permit output settings from zero to the maximum voltage and current. Resolution: 0.05% of maximum output.

PROGRAMMING: Special terminals provide for remote resistive programming of voltage or current at 100 ohms per volt. Programming terminals are also provided for programming by means of remotely located voltage or current signals.

AUTOMATIC CROSSOVER: The automatic crossover circuit switches the operating mode of the power supply automatically from constant voltage to constant current or vice versa depending on the load relationship to the panel voltage and current adjustments. In the voltage regulation mode, the current control serves as a current limit adjustment while in current regulating mode, the voltage control serves as a voltage limiting adjustment.

REMOTE ERROR SENSING: Error sensing terminals enable specified voltage regulation to be maintained directly at the load by compensating for voltage drops up to 0.5 volts across each load supply lead.

SERIES/PARALLEL OPERATION: Automatic crossover capability permits series or parallel operation in either voltage or current regulating modes. Units operate automatically to share a load by means of their automatic crossover feature. Connections are also provided for operation in master/slave configuration.

COOLING: Lateral circulation by blowers insures efficient heat transfer; permits stacking of multiple units without overheating.

SPECIFICATIONS, Physical

METERS: Model numbers in table include 2½", rectangular voltmeter and ammeter; 2% full scale accuracy. To specify an unmetered unit, delete the suffix "M" from the model no., e.g., KO 70-20, for unit without meters.

TERMINALS AND CONTROLS: *On Front Panel:* AC on-off switch, circuit breaker/fuse and pilot light, 10-turn voltage control, 10-turn current control and reference circuit fuse. *On Rear of Chassis:* Barrier strip connections for: remote error sensing, voltage and current programming by remote resistance and/or voltage, master-slave parallel operation. DC output and ground terminals. Output terminals are isolated from the chassis, either positive or negative terminal may be grounded.

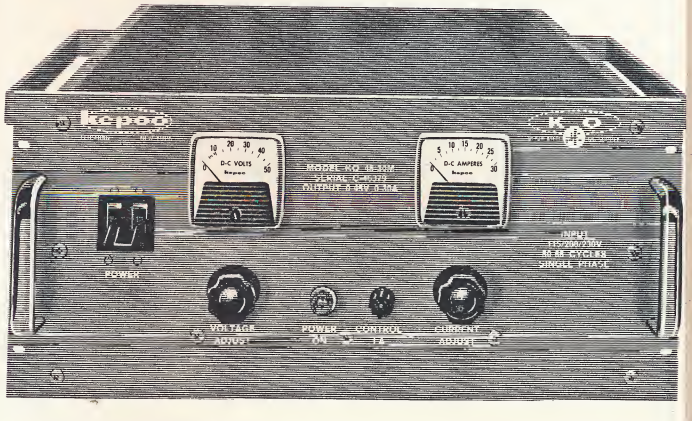
DIMENSIONS: Standard EIA rack dimensions, 8¾" H x 19" W x 20" D. Side handles and bottom skids easily removable for rack mounting. Depth is measured behind front panel, see diagram.

FINISH: Gray hammertone (special finishes to order).

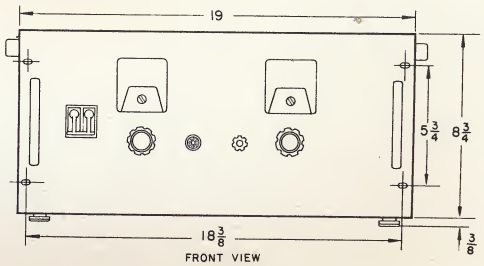
131-38 SANFORD AVENUE • FLUSHING, N.Y. 11352 • Phone: (212) IN 1-7000
TWX #212-539-6623 • Cable Address: KEPCOPOWER, NEW YORK

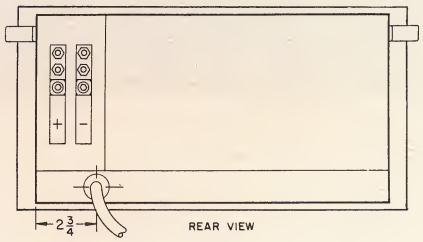
TRANSISTORIZED

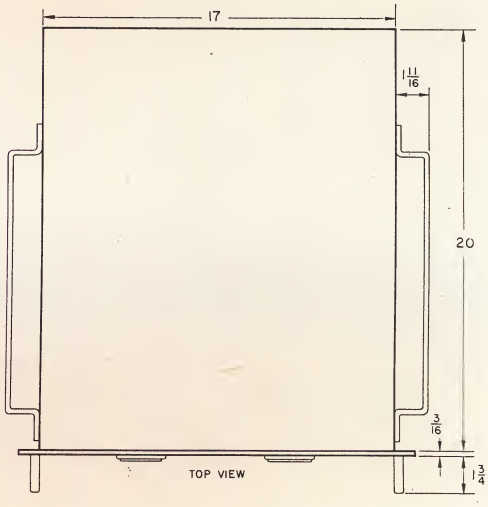
kepco KO REGULATED DC SUPPLY GROUP

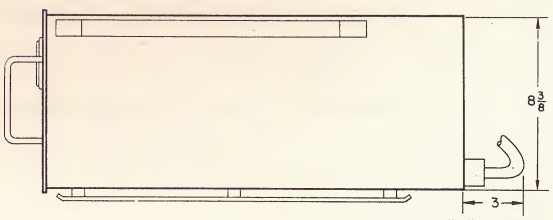


Model KO 45-30M









kepco

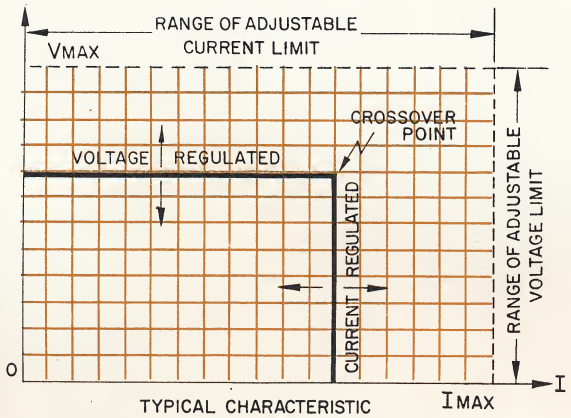
K S REGULATED DC SUPPLY GROUP

TRANSISTORIZED

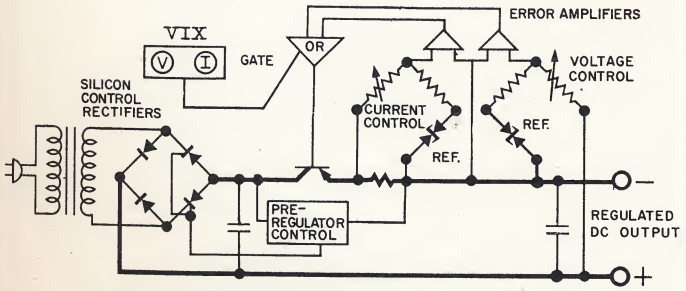
- *VIX mode indicators*
- *automatic voltage/current crossover*
- *full range programming*
- *10-turn voltage and current controls*

0.01% REGULATION and STABILITY

MODEL	DC OUTPUT RANGE		OUTPUT IMPEDANCE OHMS MAX.			DIMENSIONS			MAX. INPUT AT 125 V AC	
	VOLTS	AMPS	DC to 100 CPS	100 CPS to 1 KC	1 KC to 100 KC + μH	H	W	D	AMPS	WATTS
KS 8–15M	0–8	0–15	0.05×10^{-3}	0.01	0.04+0.4	3½″	19″	14⅜″	4.4	320
KS 8–25M	0–8	0–25	0.03×10^{-3}	0.01	0.04+0.4	5¼″	19″	16″	8.5	565
KS 8–50M	0–8	0–50	0.016×10^{-3}	0.005	0.02+0.4	7″	19″	16″	15.5	1000
KS 8–100M	0–8	0–100	0.008×10^{-3}	0.005	0.02+0.4	8¾″	19″	20″	32	1950
KS 18–10M	0–18	0–10	0.18×10^{-3}	0.01	0.04+0.5	3½″	19″	14⅜″	6.7	345
KS 18–15M	0–18	0–15	0.12×10^{-3}	0.01	0.04+0.5	5¼″	19″	16″	8.0	510
KS 18–25M	0–18	0–25	0.07×10^{-3}	0.005	0.04+0.5	7″	19″	16″	14.0	900
KS 18–50M	0–18	0–50	0.035×10^{-3}	0.005	0.02+0.2	8¾″	19″	20″	26	1800
KS 36–5M	0–36	0–5	0.7×10^{-3}	0.02	0.1 +1.0	3½″	19″	14⅜″	4.8	290
KS 36–10M	0–36	0–10	0.4×10^{-3}	0.01	0.1 +1.0	5¼″	19″	16″	8.9	580
KS 36–15M	0–36	0–15	0.25×10^{-3}	0.01	0.1 +0.6	7″	19″	16″	12.2	860
KS 36–30M	0–36	0–30	0.1×10^{-3}	0.005	0.04+0.4	8¾″	19″	20″	25	1600
KS 60–2M	0–60	0–2	3×10^{-3}	0.02	0.1 +1.0	3½″	19″	14⅜″	3.0	250
KS 60–5M	0–60	0–5	1×10^{-3}	0.02	0.1 +1.0	5¼″	19″	16″	7.0	500
KS 60–10M	0–60	0–10	0.6×10^{-3}	0.01	0.1 +1.0	7″	19″	16″	13.0	1000
KS 60–20M	0–60	0–20	0.3×10^{-3}	0.01	0.1 +0.8	8¾″	19″	20″	24	1700



TYPICAL CHARACTERISTIC
AUTOMATIC VOLTAGE/CURRENT CROSSOVER



All models are designed for continuous operation without derating under all specified line, load and temperature conditions.

SPECIFICATIONS, Voltage Regulation Mode

REGULATION: *Line:* Less than 0.01% output voltage change for 105-125V AC or 210-250V AC line variation, at any output voltage within the specified range.

Load: Less than 0.01% or 0.5 mv output voltage change, whichever is greater, for *no load* to *full load* change at any output voltage within the specified range.

STABILITY: Output voltage varies less than 0.01% or 3 mv, whichever is greater, over a period of 8 hours after warmup. Measured at constant line voltage, load and ambient temperature.

TEMPERATURE COEFFICIENT: Output voltage changes less than 0.01% per °C.

RIPPLE: Less than 1 mv rms.

RECOVERY TIME: 50 microseconds.

OUTPUT IMPEDANCE: Specified for each model within the load frequency range shown in the table. Above 10 kc include the reactive impedance of the effective series inductance as indicated.

SPECIFICATIONS, Current Regulation Mode

OUTPUT RANGE, Internal Sensing: Current regulation from less than 0.5% to 100% of the maximum specified current. Automatic crossover to voltage limiting provided.

External Sensing: Current regulation from 10 ma to 100% of the maximum rated current.

COMPLIANCE, Internal Sensing: Voltage compliance range is zero to the voltage control setting. The setting is adjustable, zero to 100% of the rated voltage range.

External Sensing: Voltage compliance range is zero to 100% of the maximum output voltage.

For any selected current value, the output voltage is automatically varied throughout the compliance range as required to regulate the output current through a variable load.

REGULATION, Internal Sensing: *Line:* Less than 0.01% or 1 ma, whichever is greater, output current change for 105-125V AC or 210-250V AC line variation at any output current within the specified range. For models rated at 10 amperes or less output current, the 1 ma regulation specification governs.

Load: Less than 0.01% or 1 ma, whichever is greater, output current change for the maximum change in load resistance within the rated compliance range. For models rated at 10 amperes or less output current, the 1 ma regulation specification governs.

REGULATION, External Sensing: *Line:* For 105-125V AC or 210-250V AC line variations, output current changes less than 0.01% when the specified voltage sample is maintained across the external sensing resistor.

Load: For the maximum change in load resistance, within the rated compliance range, output current changes less than 0.01% when the specified voltage sample is maintained across the external sensing resistor.

The sensing resistor is chosen to produce a one volt drop at the maximum operating current. A separate control is used externally to provide high resolution current adjustability.

STABILITY: Output current varies less than 0.05% or 5 ma, whichever is greater, over a period of 8 hours after warmup. Measured at constant line voltage, load and ambient temperature.

TEMPERATURE COEFFICIENT: Output current changes less than 0.05% per °C.

RIPPLE: Less than 0.1% of output current setting or 0.05% of maximum current rating, whichever is greater, rms.

SPECIFICATIONS, General

INPUT REQUIREMENTS: 105-125 or 210-250V AC, 50-65 cps single phase.

AMBIENT OPERATING TEMPERATURE: −20°C to +50°C max.

STORAGE TEMPERATURE: −40°C to +85°C maximum.

ISOLATION VOLTAGE: A maximum of 500 volts can be connected between the chassis and either output terminal.

SPECIFICATIONS, Performance

CONTROLS: Continuously adjustable 10-turn voltage and current controls permit output settings from zero to the maximum voltage and current. Resolution: 0.05% of maximum output.

PROGRAMMING: Special terminals provide for remote resistive programming of voltage or current at 100 ohms per volt. Programming terminals are also provided for programming by means of remotely located voltage or current signals.

AUTOMATIC CROSSOVER: The automatic crossover circuit switches the operating mode of the power supply automatically from constant voltage to constant current or vice versa depending on the load relationship to the panel voltage and current adjustments. In the voltage regulation mode, the current control serves as a current limit adjustment while in current regulating mode, the voltage control serves as a voltage limiting adjustment.

VIX INDICATORS: The power supply's operating mode is indicated by a pair of front-panel signal lamps. One lamp is lighted during voltage regulated operation, the other during current regulated operation (internal current sensing only). Crossover from one mode to the other is signalled by the extinction of one lamp and the lighting of the other.

VIX REMOTE SIGNAL: A pair of rear-panel pin jacks, labelled "V" and "I" provide external access to the VIX signal. Pin V is 8 volts positive with respect to pin I during voltage regulated operation. Pin I is 8 volts positive with respect to pin V during current regulated operation. Maximum loading: 10K ohms; isolated from ground and the output terminals of the power supply. Crossover from one mode to the other is signalled by an abrupt polarity reversal.

REMOTE ERROR SENSING: Error sensing terminals enable specified voltage regulation to be maintained directly at the load by compensating for voltage drops up to 0.5 volts across each load supply lead.

SERIES/PARALLEL OPERATION: Automatic crossover capability permits series or parallel operation in either voltage or current regulating modes. Units operate automatically to share a load by means of their automatic crossover feature. Connections are also provided for operation in master/slave configuration.

COOLING: Lateral circulation by blowers insures efficient heat transfer; permits stacking of multiple units without overheating.

OVERSHOOT: No output voltage overshoot from turn-on, turn-off or power failure for output settings above 25% of max. rated voltage. Below 25%, output overshoot is a function of load and is negligible for loads in excess of 10%.

SPECIFICATIONS, Physical

METERS: Model numbers in table include 2½", rectangular voltmeter and ammeter; 2% full scale accuracy. To specify an unmetered unit, delete the suffix "M" from the model no., e.g., KS 8-100, for unit without meters.

TERMINALS AND CONTROLS: *On Front Panel:* AC on-off switch, circuit breaker/fuse and two VIX mode lamps. 10-turn voltage control, 10-turn current control, reference circuit fuse, DC output and ground terminals (8¾" models have output terminals on the rear only).

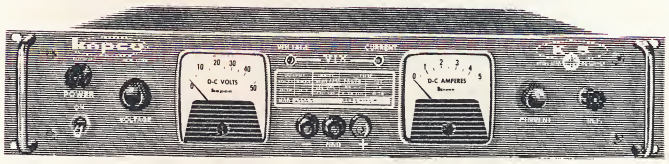
On Rear of Chassis: Two VIX remote signal 0.08" pin jacks. Barrier strip connections for: remote error sensing, voltage and current programming by remote resistance and/or voltage, master-slave, parallel operation, external current sensing. DC output and ground terminals. Output terminals are isolated from the chassis, either positive or negative terminal may be grounded.

DIMENSIONS: Standard EIA rack dimensions. Side handles and bottom skids easily removable for rack mounting (8¾" models). See table for dimensions of each model. Depth is measured behind front panel.

FINISH: Gray hammertone (special finishes to order).

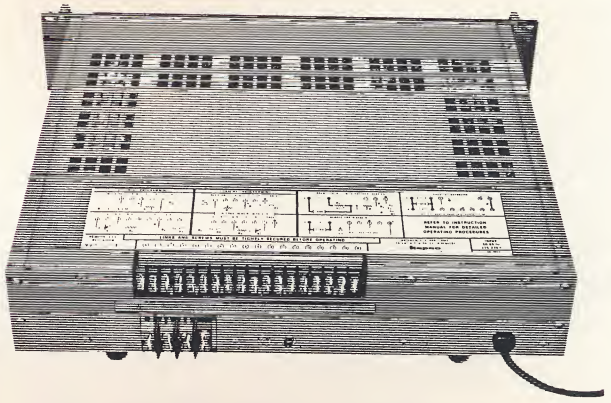
TRANSISTORIZED

kepco KS REGULATED DC SUPPLY GROUP



Model KS 36-5M

Model KS 36-30M



TYPICAL REAR VIEW SHOWING ACCESSIBLE TERMINAL BLOCKS WITH SIMPLIFIED CONNECTION GUIDE AND PROVISIONS FOR VIX REMOTE SIGNALING

Data subject to change without notice
PATENT NOTICE: Applicable Patent Nos. will be supplied on request.

kepco

PAX

REGULATED DC SUPPLY

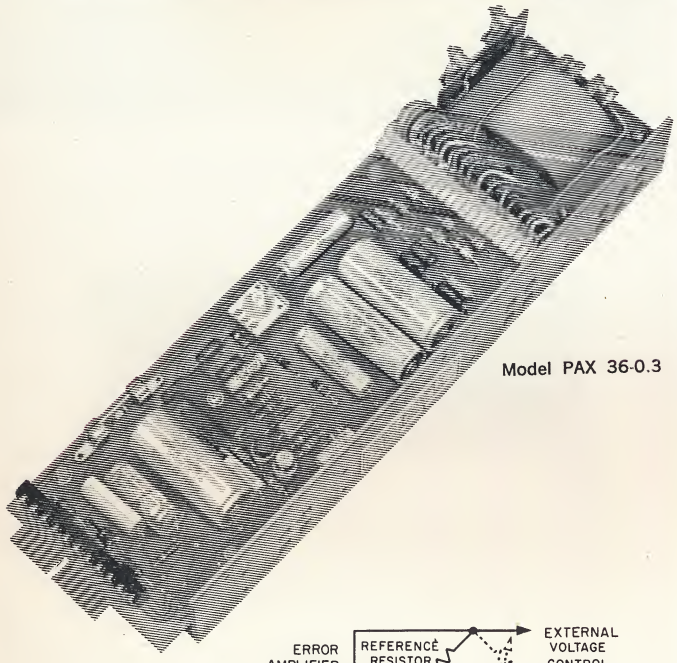
TRANSISTORIZED

MODULAR GROUP

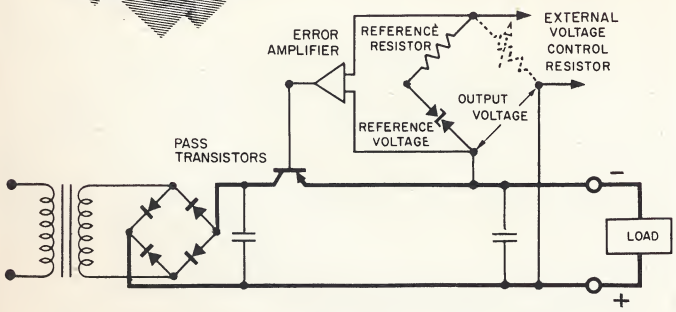
- *voltage/current regulation*
- *full range programming*
- *laboratory or systems use*
- *versatile, compact design*
- *high-speed option*

0.05% REGULATION and STABILITY

MODEL	DC OUTPUT RANGE		OUTPUT IMPEDANCE OHMS MAX.			MAX. INPUT AMPS
	VOLTS	AMPS	DC to 100 CPS	100 CPS to 1 KC	1 KC to 100 KC + μh	At 125 V AC
PAX 7–1	0–7	0–1	0.004	0.02	0.1+1	0.3
PAX 15–0.75	0–15	0–0.75	0.010	0.02	0.1+1	0.3
PAX 21–0.5	0–21	0–0.5	0.025	0.02	0.1+1	0.3
PAX 36–0.3	0–36	0–0.3	0.06	0.02	0.1+1	0.3
PAX 72–0.15	0–72	0–0.15	0.25	0.02	0.1+1	0.3
PAX 100–0.1	0–100	0–0.1	0.5	0.02	0.1+1	0.3



Model PAX 36-0.3



All models are designed for continuous operation without derating under all specified line, load and temperature conditions.

SPECIFICATIONS, Voltage Regulation Mode

REGULATION: *Line:* Less than 0.05% or 1 mv output voltage change, whichever is greater for 105-125V AC or 210-250V AC line variation, at any output voltage within the specified range.

Load: Less than 0.05% or 1 mv output voltage change, whichever is greater, for *no load* to *full load* change at any output voltage within the specified range.

STABILITY: Output voltage varies less than 0.05% or 3 mv, whichever is greater, over a period of 8 hours after warmup, measured at constant line voltage, load and ambient temperature. (see "Controls").

TEMPERATURE COEFFICIENT: Output voltage changes less than 0.05% per °C, (see "Controls").

RIPPLE: Less than 0.25 mv rms.

RECOVERY TIME: 50 microseconds.

OUTPUT IMPEDANCE: Specified for each model within the load frequency range shown in the table. Above 10 kc include the reactive impedance of the effective series inductance as indicated.

SPECIFICATIONS, Current Regulation Mode

External Sensing

OUTPUT RANGE: Current regulation from 1 ma to 100% of the maximum rated current.

COMPLIANCE: Voltage compliance range is zero to 100% of the maximum output voltage.

For any selected current value, the output voltage is automatically varied throughout the compliance range as required to regulate the output current through a variable load.

REGULATION: *Line:* For 105-125V AC or 210-250V AC line variations, output current changes less than 0.1% when the specified voltage sample is maintained across the external sensing resistor.

Load: For the maximum change in load resistance, within the rated compliance range, output current changes less than 0.1% when the specified voltage sample is maintained across the external sensing resistor.

The sensing resistor is chosen to produce a one volt drop at the maximum operating current. A separate control is used externally to provide high resolution current adjustability.

STABILITY: Output current varies less than 0.1% or 1 ma, whichever is greater, over a period of 8 hours after warmup. Measured at constant line voltage, load and ambient temperature.

TEMPERATURE COEFFICIENT: Output current changes less than 0.1% per °C.

RIPPLE: Less than 0.1% of maximum current rms.

SPECIFICATIONS, General

INPUT REQUIREMENTS: 105-125 or 210-250V AC, 50-440 cps single phase.

AMBIENT OPERATING TEMPERATURE: −20°C to +50°C maximum.

STORAGE TEMPERATURE: −40°C to +85°C maximum.

ISOLATION VOLTAGE: A maximum of 500 volts can be connected between the chassis and either output terminal.

SPECIFICATIONS, Performance

CONTROLS: PAX Modules are ordinarily supplied without controls. External fixed or variable programming resistors are used to control the output. Optionally, on special order, a built-in trimmer can be provided for up to 20 volts adjustment range. Stability and temperature coefficient criteria require the use of high quality LTC, 20 PPM wire wound elements for programming.

PROGRAMMING: Terminals provide for resistive programming of voltage or current at approximately 1000 ohms per volt. Programming terminals are also provided for programming by means of remotely located voltage or current signals.

Optionally, on special order, a built-in trimmer can be provided to adjust the control ratio over a 10% range so that exact value fixed programming resistances can be used.

HIGH SPEED OPTION: PAX Modules are provided with a choice of regulators for standard service or high speed operation. To designate a high speed PAX, add the suffix "HS" to the model number, e.g., PAX 21-0.5HS.

The HS regulator emphasizes the amplifier-like characteristics of the PAX Module, providing increased output circuit bandwidth by eliminating the capacitive output filtering.

High speed characteristics, operationally programmed:

Unity gain-bandwidth: 100 kc; slope: −6 db per octave
Maximum slewing rate: 50,000 volts per second
Open loop DC gain: in excess of 80 db
Sinusoidal frequency response: $f_{max.} = \frac{50{,}000}{\pi E_{pp}}$ cps $\cong \frac{16}{E_{pp}}$ kc.
(E_{pp} is the peak to peak output voltage excursion.)
Maximum capacitive loading: 0.001 μf.
Ripple: 5 mv rms.
AC output impedance: 0.1 kc to 100 kc; 0.2Ω + 15 μh.

High speed and standard regulators are available separately as plug-in printed circuit cards. Combined with the basic power unit chassis (PS 7, PS 36, etc.), they form a flexible amplifier/power supply system. See Accessory Page 46 for detailed listing of model designations.

CURRENT LIMIT CONTROL: A single-turn control provides adjustable current limiting from 25% to 150% of rated full-load current.

SHORT CIRCUIT PROTECTION: Unique current limiting circuitry permits continuous operation into a short circuit without the aid of fuses, circuit breakers or relays. Output returns instantly to the operating voltage when the overload is removed.

REMOTE ERROR SENSING: Error sensing terminals enable specified voltage regulation to be maintained directly at the load by compensating for voltage drops up to 0.5 volts across each load supply lead.

SERIES/PARALLEL OPERATION: Current limiting capability permits series or parallel operation. In parallel, units operate automatically to share a load by means of the current limiting feature.

COOLING: Heat removal is by natural convection, no blowers.

OVERSHOOT: No output voltage overshoot from turn-on, turn-off or power failure for output settings above 25% of max. rated voltage. Below 25%, output overshoot is a function of load and is negligible for loads in excess of 10%.

SPECIFICATIONS, Physical

TERMINALS AND CONTROLS: *On Rear:* 11-terminal barrier strip and provision for accepting a 12-terminal printed circuit connector for AC input, DC output, error sensing and programming control functions. Output terminals are isolated from ground and either positive or negative output may be grounded.

DIMENSIONS: 2½" H x 3 13/16" W x 12 13/16" D. Uncased for chassis mounting.

Cased Unit: To specify cased unit, add suffix "C" to model no., e.g., PAX 36-0.3C for module with case.

Cased Dimensions: 2 11/16" H x 4⅛" W x 13 3/16" D.

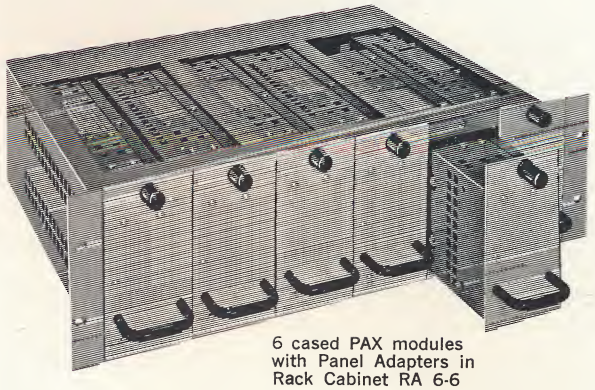
Various mounting accessories are available, including rack cabinets for plug-in mounting of four or six PAX Modules, and rack adapters mounting one, four or six units. See Accessory Page 46 for a detailed description, and dimensioned drawings of PAX accessories.

STANDARD FINISH: *Case and Chassis:* Blue anodized aluminum. *Panel Adapter:* Etched aluminum-brushed and coated. (special finishes to order).

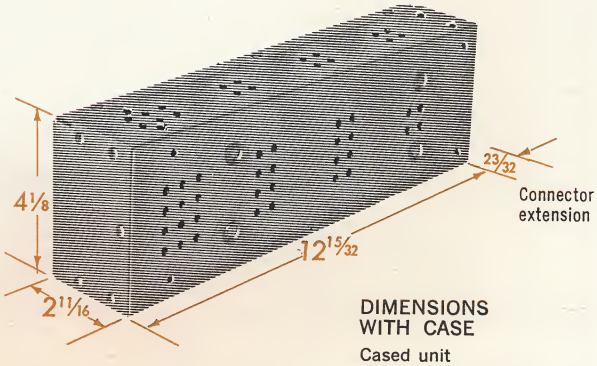
TRANSISTORIZED

kepco PAX REGULATED DC SUPPLY

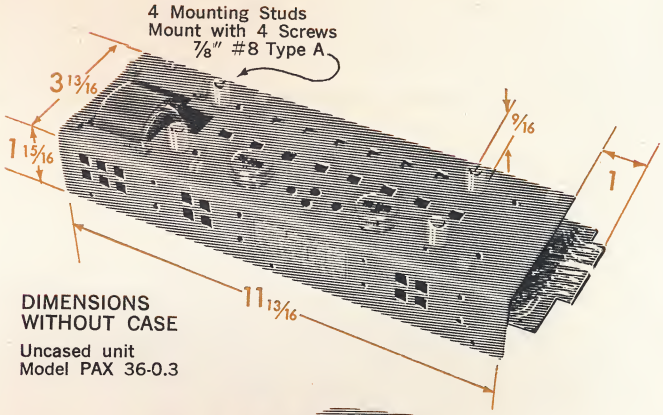
MODULAR GROUP



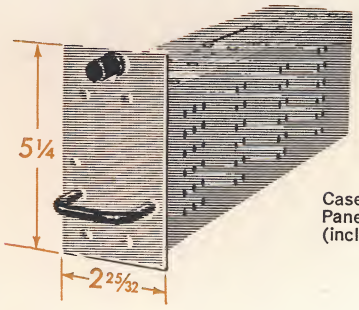
6 cased PAX modules with Panel Adapters in Rack Cabinet RA 6-6



DIMENSIONS WITH CASE
Cased unit
Model PAX 36-0.3C



DIMENSIONS WITHOUT CASE
Uncased unit
Model PAX 36-0.3



Cased unit with Panel Adapter RAP 6-1 (includes handle and fastener)

Data subject to change without notice
PATENT NOTICE: Applicable Patent Nos. will be supplied on request.

kepco

PR

REGULATED DC SUPPLY

GROUP

SOLID STATE

- *constant voltage transformer regulator*
- *wide voltage range*
- *high current*

SINGLE PHASE INPUT

±1% LINE REGULATION

MODEL	DC OUTPUT RANGE VOLTS	DC OUTPUT RANGE AMPS	RIPPLE RMS %	OUTPUT IMPEDANCE OHMS MAX. 1 KC to 10 KC	OUTPUT IMPEDANCE OHMS MAX. 10 KC to 100 KC + μH	DIMENSIONS H	DIMENSIONS W	DIMENSIONS D	MAX. INPUT AMPS AT 125 V AC
PR 15–10M	0-7.5-15	0-10	2	0.02	0.04+0.1	3½″	19″	13⅞″	3.5
PR 15–30M	0-15	0-30	2	0.02	0.04+0.1	7″	19″	13⅞″	7.0
PR 38–5M	0-19-38	0-5	1	0.03	0.04+0.1	3½″	19″	13⅞″	4.0
PR 38–15M	0-38	0-15	1	0.03	0.04+0.2	7″	19″	13⅞″	9.0
PR 80–2.5M	0-40-80	0-2.5	0.7	0.04	0.04+0.1	3½″	19″	13⅞″	3.5
PR 80–8M	0-80	0-8	0.7	0.05	0.07+0.5	7″	19″	13⅞″	9.5
PR 155–1M	0-78-155	0-1	0.6	0.1	0.1 +0.1	3½″	19″	13⅞″	3.0
PR 155–4M	0-155	0-4	0.6	0.1	0.1 +0.5	7″	19″	13⅞″	9.0
PR 220–3M	0-220	0-3	0.5	0.2	0.1 +0.5	7″	19″	13⅞″	10.0
PR 310–0.6M	0-165-310	0-0.6	0.5	0.3	0.1 +0.1	3½″	19″	13⅞″	3.0
PR 310–2M	0-310	0-2	0.5	0.3	0.1 +0.5	7″	19″	13⅞″	9.0

FIGURE 1

3-PHASE INPUT

±2% LINE REGULATION

MODEL	DC OUTPUT RANGE VOLTS	DC OUTPUT RANGE AMPS	RIPPLE RMS %	OUTPUT IMPEDANCE OHMS MAX. 1 KC to 10 KC	OUTPUT IMPEDANCE OHMS MAX. 10 KC to 100 KC + μH	DIMENSIONS H	DIMENSIONS W	DIMENSIONS D	MAX. INPUT AMPS AT 230 V AC
PR 20–100AM	0-20	0-100	3	0.05	0.06+0.1	8¾″	19″	20″	9.0/ø
PR 40–50AM	0-40	0-50	2	0.05	0.06+0.1	8¾″	19″	20″	8.5/ø
PR 50–40AM	0-50	0-40	1.5	0.05	0.06+0.1	8¾″	19″	20″	8.5/ø

FIGURE 1

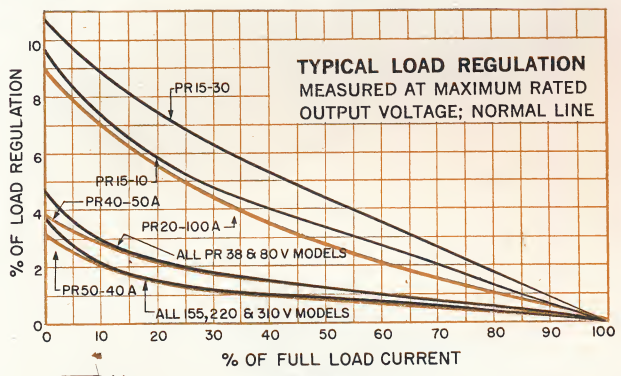
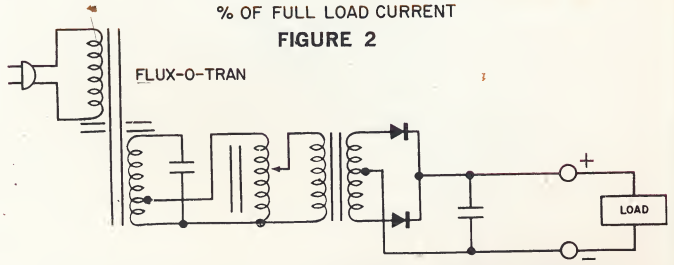


FIGURE 2



All models are designed for continuous operation without derating under all specified line, load and temperature conditions.

SPECIFICATIONS, General

REGULATION:

LINE Less than ±1% output voltage change for 115V±10V AC line variation at any output voltage within the load range specified in Figure 4. For models with 3-phase input, line regulation is ±2% for line variations of ±10%.

LOAD—*At maximum output voltage:* Less than 2% output voltage change for HALF LOAD to FULL LOAD change (except 5% regulation for 15 and 20 volt models).

Less than 4% output voltage change for QUARTER LOAD to FULL LOAD change (except 8% regulation for 15 and 20 volt models). (See Figures 2 and 4.)

STABILITY:

Output varies less than 1% or 0.1V whichever is greater over a period of 8 hours after warmup. Measured at constant line voltage, load and ambient temperature.

RIPPLE:

For maximum % ripple at maximum rated output voltage and current, see Figure 1. For typical ripple values at reduced output currents see Figure 3. At lower output voltages the absolute value of the ripple is less than at maximum output voltage.

TEMPERATURE COEFFICIENT:

Output voltage changes less than 0.05% per °C.

AMBIENT OPERATING TEMPERATURE:

–20°C to +55°C maximum.

STORAGE TEMPERATURE:

–40°C to +85°C maximum.

OUTPUT IMPEDANCE:

Specified for each model within the load frequency range shown in the table. Below 1000 cps, impedance is a function of load current and is determined by reference to the load regulation curve. Impedance is the slope of the curve ΔE/ΔI.

Above 10 kc include the reactive impedance of the effective series inductance as indicated.

INPUT REQUIREMENTS:

(For all 3½″ and 7″ high models): 115±10V AC 60 cps ±5% single phase.

(For all 8¾″ high models): 208 or 230V AC±10%, 60 cps ±5% three phase, 3-wire.

For models to operate at 104 ± 9V AC; 115 ± 10V AC; 208 ± 18V AC or 230 ± 20V AC, 50 cps ± 5%, add suffix "–50" to the model number and derate output *voltage* by 20%.

Note: % changes in line frequency produce approximately equal % changes in output voltage linearly within stated input frequency tolerances.

SPECIFICATIONS, Performance

CONTROLS:

Continuously variable voltage control permits output settings from 0.2% of maximum voltage to the maximum output voltage. Resolution ≅1% of maximum output voltage. On 3½″ high models, the output is variable over two continuous ranges.

Data subject to change without notice
PATENT NOTICE: Applicable Patent Nos. will be supplied on request.

kepco®

PARALLEL CONNECTION:
Units can be paralleled by adjusting the individual voltage controls to share the load.

CONSTANT VOLTAGE TRANSFORMER:
Flux-O-Tran power transformer delivers regulated square wave voltage to rectifiers, improving rectifier utilization and reducing output ripple.

OVERLOAD PROTECTION:
Special Flux-O-Tran power transformer and DC overload circuit breaker allows output to be shorted without adverse effect.

SILICON RECTIFIERS:
Reliable, efficient, full wave rectification.

CAPACITIVE FILTER:
No series choke, capacitive filtering provides excellent ripple reduction and minimizes transient response characteristics.

FORCED AIR COOLING:
Lateral circulation by blowers insures efficient heat transfer; permits stacking of units without overheating.

OVERSHOOT:
No output voltage overshoot from turn-on, turn-off or power failure for output settings above 25% of max. rated voltage. Below 25%, output overshoot is a function of load and is negligible for loads in excess of 10%.

ISOLATION VOLTAGE:
A maximum of 600 volts can be connected between the chassis and either output terminal.

SPECIFICATIONS, Physical

METERS:
Model numbers in table include 2½" voltmeter and ammeter; 2% full scale accuracy. To specify unmetered unit, delete the suffix "M" from the model number, eg., PR 155-4 for unit without meters.

TERMINALS AND CONTROLS:
On Front Panel: 3½" and 7" (single phase) units: DC output and ground (5-way) output terminals, voltage control, AC fuse, DC circuit breaker, pilot light. 7" units have conventional power on-off toggle switch, 3½" units have a combination on-off switch and 2 position range selector. 8¾" (3-phase) units: Combination on-off switch – circuit breaker, pilot light and voltage control.

On Rear of Chassis: DC output and ground terminals. All output terminals are isolated from the chassis, either positive or negative output may be grounded.

DIMENSIONS:
Standard EIA rack dimensions.

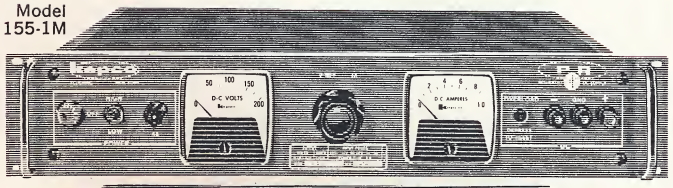
See table for specification of each model. Depth is measured behind front panel. On 8¾" models, side handles and bottom skids are easily removable for rack mounting. Heavy duty line cord is mounted at the rear, allow 3" minimum bend radius.

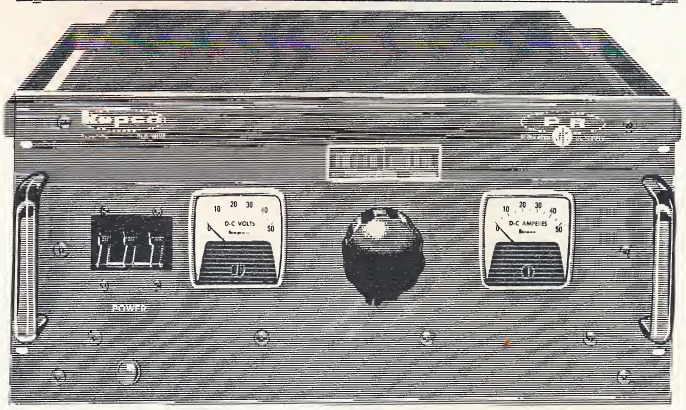
STANDARD FINISH:
Gray hammertone (special finishes to order).

131-38 SANFORD AVENUE • FLUSHING, N.Y. 11352 • Phone: (212) IN 1-7000
TWX #212-539-6623 • Cable Address: KEPCOPOWER, NEWYORK

kepco
SOLID STATE
PR
REGULATED DC SUPPLY
GROUP

Model PR 155-1M





Model PR 40-50AM

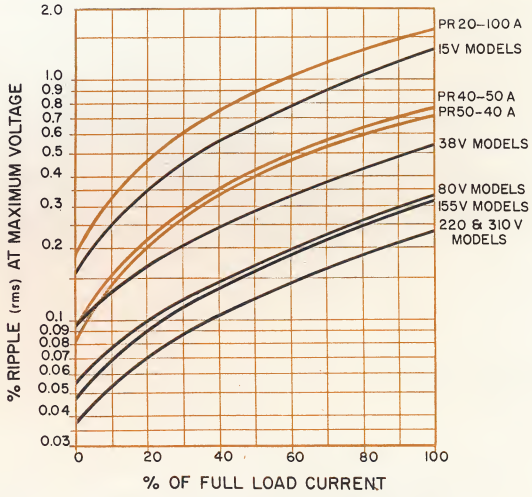


FIGURE 3 TYPICAL RIPPLE CHARACTERISTICS AS A FUNCTION OF LOAD CURRENT

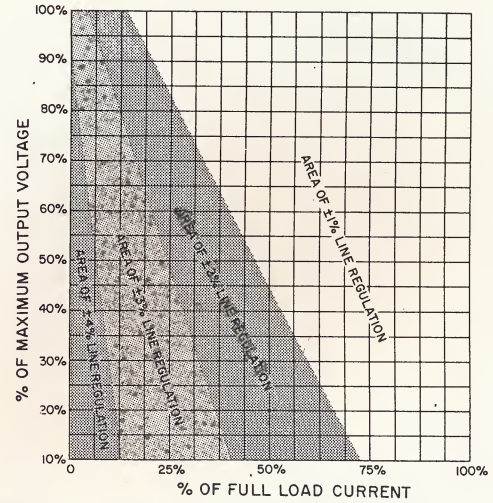


FIGURE 4 LINE REGULATION, 1-PHASE MODELS AS A FUNCTION OF OUTPUT VOLTAGE AND LOAD CURRENT

kepco

PRM

REGULATED DC SUPPLY

SOLID STATE

MODULAR GROUP

- *more DC output watts per dollar, per pound, per cubic inch*
- *highly reliable, maintenance-free operation assured by good design and basic simplicity*
- *fixed DC output voltages*

±1% LINE REGULATION

MODEL	DC OUPUT VOLTS	DC OUPUT AMPS	LOAD REGULATION* ΔV INCREASE 100% to 50% LOAD	LOAD REGULATION* ΔV INCREASE 100% to 25% LOAD	RIPPLE (MAX) RMS VOLTS	SIZE	SERIES
PRM 6–15	6.3	0–15	0.5	0.7	0.4	B	120
PRM 6–25	6.3	0–25	0.4	0.6	0.4	A	180
PRM 12–10	12	0–10	0.6	1.0	0.4	B	120
PRM 12–15	12	0–15	0.4	0.8	0.4	A	180
PRM 18–6.7	18	0–6.7	0.8	1.3	0.3	B	120
PRM 18–10	18	0–10	0.5	0.9	0.3	A	180
PRM 24–5	24	0–5	1.0	1.7	0.3	B	120
PRM 24–8	24	0–8	0.5	0.9	0.3	A	180
PRM 28–4.3	28	0–4.3	1.2	2.0	0.3	B	120
PRM 28–7	28	0–7	0.5	0.9	0.4	A	180
PRM 36–3.3	36	0–3.3	1.5	2.4	0.3	B	120
PRM 36–5	36	0–5	0.8	1.3	0.4	A	180
PRM 48–2.5	48	0–2.5	1.8	3.1	0.3	B	120
PRM 48–4	48	0–4	1.0	1.8	0.3	A	180
PRM 60–2	60	0–2	2.3	3.8	0.3	B	120
PRM 60–3	60	0–3	1.0	1.8	0.3	A	180
PRM 120–1	120	0–1	4.3	7.3	0.3	B	120
PRM 120–1.5	120	0–1.5	2.2	3.6	0.3	A	180

FIGURE 1 * Measured at 115V AC Line

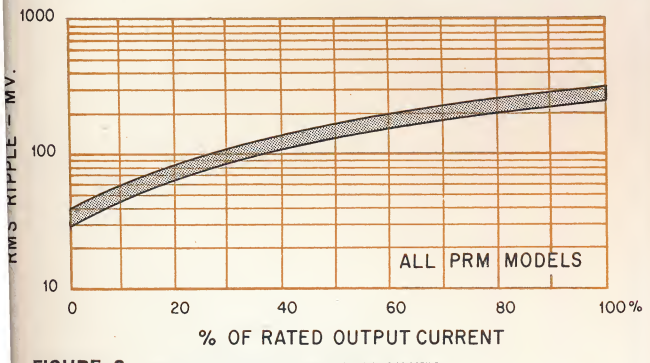
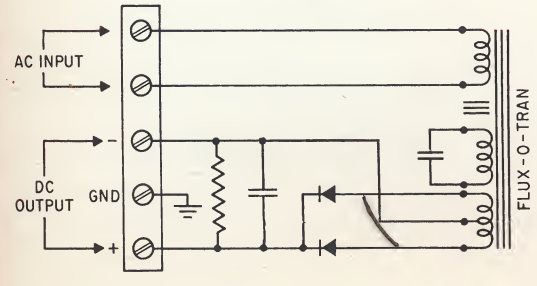


FIGURE 2 TYPICAL RIPPLE FOR PRM UNITS AS A FUNCTION OF LOAD



SPECIFICATIONS, General

REGULATION: LINE: Less than ±1% output voltage change for 115±15V AC line variation at loads greater than 25% of rating. Below 25% load, the output voltage change is less than ±1.5%.

LOAD: See Figure 1 for maximum specification. See Figure 3 for typical load regulation curves.

ACCURACY: ±2% of specified output voltage at nominal line, full load and 30°C ambient temperature.

STABILITY: Output varies less than 1% or 0.1V whichever is greater over a period of 8 hours after warmup. Measured at constant line voltage, load and ambient temperature.

TEMPERATURE COEFFICIENT: Output voltage changes less than 0.05% per °C.

RIPPLE: For maximum ripple at maximum rated output voltage and current, see Figure 1. For typical ripple values at reduced output currents see Figure 2.

AMBIENT OPERATING TEMPERATURE: —20°C to +55°C maximum.

STORAGE TEMPERATURE: —40°C to +85°C maximum.

OUTPUT IMPEDANCE: Same for all models: 1 kc to 10 kc less than 0.05 ohms; 10 kc to 100 kc less than 0.05 ohms plus 0.5 uh effective series inductance. Below 1000 cps, impedance is a function of load current and is determined by reference to the load regulation curve. Impedance is the slope of the curve $\Delta E/\Delta I$.

INPUT REQUIREMENTS: 115V±15V AC, 60 cps ±5%. Input current is approximately 3 amperes (280 watts) for the "A" style PRM supplies, approximately 2 amperes (190 watts) for the "B" style units. External fusing is required.

For models to operate at 104 ± 11.5V AC; 115 ± 15V AC; 208 ± 23V AC or 230 ± 30V AC, 50 cps ± 5%, add suffix "–50" to model number and derate output *current* by 20%.

Note: % changes in line frequency produce approximately equal % changes in output voltage linearly, within stated input frequency tolerances.

SPECIFICATIONS, Performance

CONSTANT VOLTAGE TRANSFORMER: Flux-O-Tran power transformer delivers regulated square wave voltage to rectifiers, improving rectifier and capacitor utilization and reducing output ripple.

OVERLOAD PROTECTION: Special Flux-O-Tran power transformer allows output to be shorted without adverse effect.

SILICON RECTIFIERS: Reliable, efficient, full wave rectification.

CAPACITIVE FILTER: Capacitive filtering provides excellent ripple reduction and minimizes transients.

CONVECTION COOLING: Heat removal is by natural convection.

ISOLATION VOLTAGE: A maximum of 600 volts can be connected between the chassis and either output terminal.

PARALLEL OPERATION: Supplies of the same model numbers can be paralleled for increased current.

SERIES OPERATION: Supplies can be series connected for increased voltage.

SPECIFICATIONS, Physical

TERMINALS AND CONTROLS: *On Rear of Chassis:* Barrier strip terminals provide for AC input, DC output and ground connections. Output terminals are isolated from ground and either positive or negative output may be grounded.

DIMENSIONS:
Size A: *Uncased:* 6¾" H x 4¾" W x 10⅜" D
Cased: 6 15/16" H x 5" W x 10 7/16" D
Size B: *Cased only:* 3 13/32" H x 5" W x 13 13/16" D

STANDARD FINISH: CASES: Blue finished aluminum, (special finishes to order). "A" units chassis: cadmium plated, cronak wash.

ACCESSORIES: "A" units available with or without case, to specify cased unit, add suffix "C" to the model number eg: PRM 24-8C. Case includes wraparound, end plate and 4 removable feet for bench use.

RACK ADAPTERS: For 180 Series:
RA 8-2 (5¼" H x 19" W) for (2) A size PRM modules.
RA 9-3 (7" H x 19" W) for (3) A size PRM modules.
RA 10-1 (5¼" H x 19" W) for (1) A size PRM module.
RA 18-1 (5¼" H x 19" W) for (1) Extra Filtered module.

For 120 Series:
RA 14-3 (3½" H x 19" W) for (3) B size PRM modules.
RA 15-1 (3½" H x 19" W) for (1) B size PRM module.
RA 16-4 (5¼" H x 19" W) for (4) B size PRM modules.
RA 17-5 (5¼" H x 19" W) for (5) B size PRM modules.

Finish: Frosty etch, clear epoxy coating. (special finishes to order). See Accessory Page 47 for outline dimensions.

CUSTOM OPTIONS: Special models available with custom ratings. Contact your nearest Kepco sales engineer with your special requirements.

Extra Filtered Models: Units in the 180 series (Size A only) can be ordered with extra filtering by appending the suffix "F" to the model number. The added filter is an extra LC section which reduces ripple more than 10:1. The added choke introduces a 2% drop in the nominal voltage rating at full load. Alternatively, at the user's option, the nominal voltage is restored by a 10% reduction in output current. Size is increased to 14⅜" in the longest dimension (uncased), 14 7/16" cased. The end dimensions remain 6¾" H x 4¾" W, uncased, 6 15/16" H x 5" W, cased.

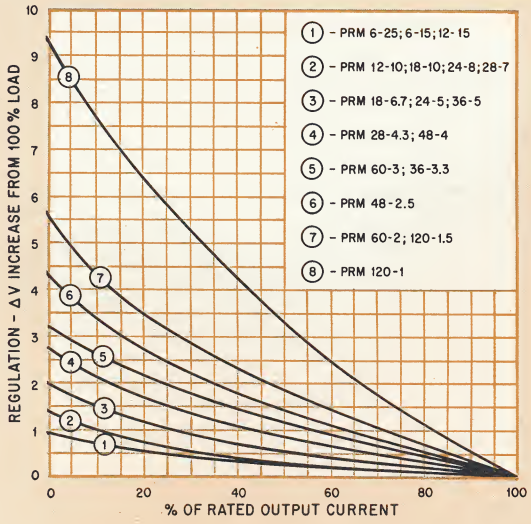
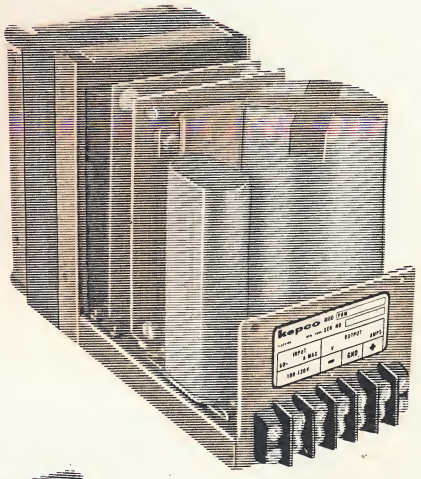


FIGURE 3 TYPICAL LOAD REGULATION FOR PRM UNITS

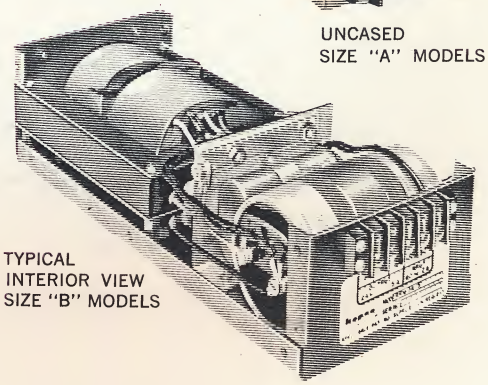
All models are designed for continuous operation without derating under all specified line, load and temperature conditions.

SOLID STATE

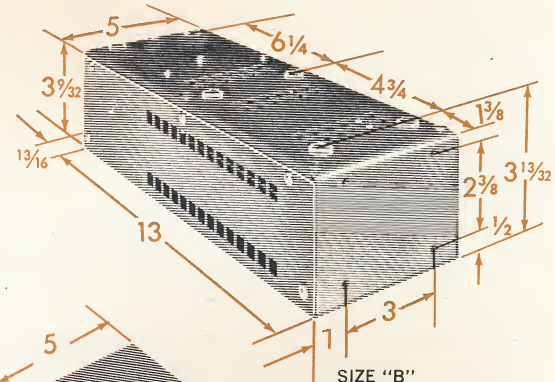
kepco
PRM
REGULATED DC SUPPLY
MODULAR GROUP



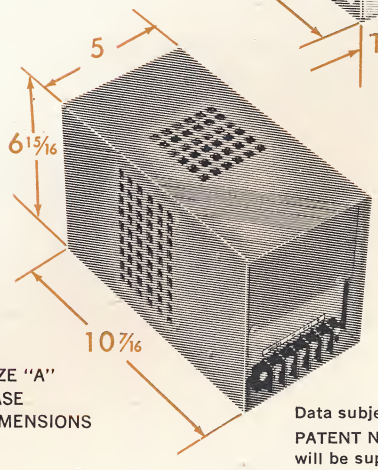
UNCASED
SIZE "A" MODELS



TYPICAL
INTERIOR VIEW
SIZE "B" MODELS



SIZE "B"
CASE and MOUNTING
DIMENSIONS



SIZE "A"
CASE
DIMENSIONS

Data subject to change without notice
PATENT NOTICE: Applicable Patent Nos. will be supplied on request.

kepco

PWR

REGULATED DC SUPPLY

TRANSISTORIZED

MODULAR GROUP

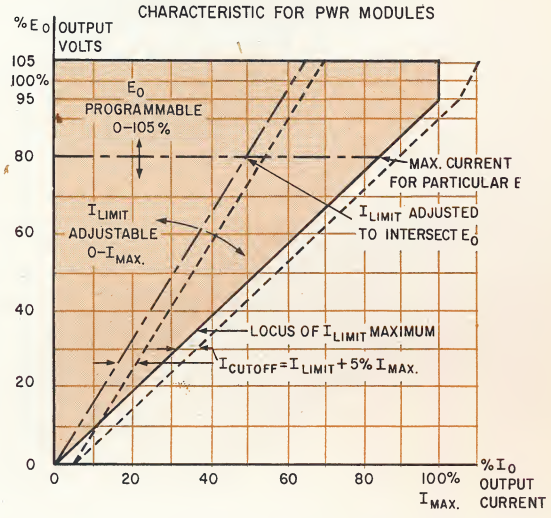
- *all silicon design*
- *modular packaging*
- *unique current cut-off protects load*
- *precision regulation*
- *full range programming*

REGULATION

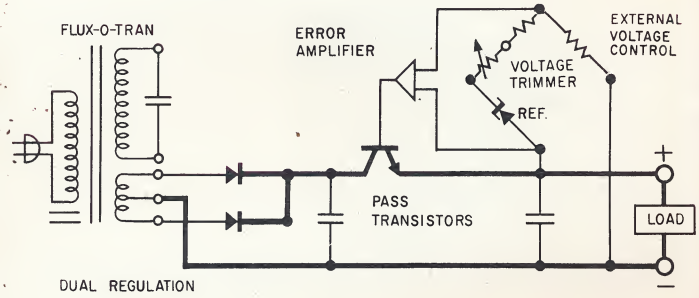
0.005% LINE — 0.05% LOAD

MODEL	DC OUTPUT VOLTS	DC OUTPUT AMPS	OUTPUT IMPEDANCE OHMS MAX DC to 100 cps	100 cps to 1 kc	1 kc to 100 kc+μh
PWR 12–7	0–12	0–7	0.001	0.005	0.1 + 0.5μh
PWR 15–6	0–15	0–6	0.002	0.005	0.1 + 0.5μh
PWR 24–4	0–24	0–4	0.003	0.005	0.05 + 0.5μh
PWR 28–3.3	0–28	0–3.3	0.004	0.005	0.05 + 0.5μh
PWR 48–2	0–48	0–2	0.015	0.005	0.05 + 0.5μh
PWR 60–1.5	0–60	0–1.5	0.02	0.005	0.05 + 0.5μh

OPERATING REGION AND OVERLOAD CHARACTERISTIC FOR PWR MODULES



I_{LIMIT} IS THE MAXIMUM OPERATING CURRENT FOR ANY SELECTED CUTOFF CURRENT. I_{LIMIT} IS APPROXIMATELY EQUAL TO I_{CUTOFF} MINUS 5% $I_{MAX.}$



SPECIFICATIONS, Voltage Regulation Mode

REGULATION: *Line:* Less than 0.005% output voltage change for 100-130V AC variation.
Load: Less than 0.05% or 1 mv output voltage change, whichever is greater, for output current changes from *no load* to the *current limit* locus.

STABILITY: Output voltage varies less than 0.05% or 3 millivolts, whichever is greater, over a period of 8 hours after warmup. Measured at constant line voltage, load and ambient temperature. (See "Controls").

TEMPERATURE COEFFICIENT: Output voltage changes less than 0.05% per °C. (See "Controls").

RIPPLE: Less than 0.25 mv rms.

RECOVERY TIME: 50 microseconds.

OUTPUT IMPEDANCE: Specified for each model within the load frequency range shown in the table. Above 10 kc include the reactive impedance of the effective series inductance as indicated.

SPECIFICATIONS, Current Regulation Mode

External Sensing

OUTPUT RANGE: Current regulation from 1 ma to 100% of the maximum rated current.

COMPLIANCE: Voltage compliance is from the intercept of the I_{LIMIT} locus to 105% of the rated maximum output voltage. For any selected current value, the compliance is the portion of the current line lying within the shaded portion of the operating region plot. The output voltage automatically varies throughout this region as required to regulate current through a variable load. For loads which require compliance outside of the operating region (below the limit locus), the current cut-off characteristic controls the output.

REGULATION: *Line:* For 100-130V AC line variations, output current changes less than 0.05% when the specified voltage sample is maintained across the external sensing resistor.
Load: For the maximum change in load resistance, within the rated compliance range, output current changes less than 0.1% when the specified voltage sample is maintained across the external sensing resistor.
The sensing resistor is chosen to produce a 1 volt drop at the maximum operating current. A separate control is used externally to provide high resolution current adjustability.

STABILITY: Output current varies less than 0.1% or 1 ma, whichever is greater, over a period of 8 hours after warmup. Measured at constant line voltage, load and ambient temperature.

TEMPERATURE COEFFICIENT: Output current changes less than 0.1% per °C.

RIPPLE: Less than 0.1% of maximum current, rms.

INPUT REQUIREMENTS: 100-130V AC, 60 cps ±1 cps single phase. Input current approximately 2 amperes, 200 watts. For models to operate at 104 ±11.5V AC; 115 ±15V AC; 208 ±23V AC or 230 ±30V AC, 50 cps ±1 cps, add suffix "−50" to model number and derate output *current* by 20%.

AMBIENT OPERATING TEMPERATURE:
Uncased: −20°C to +65°C maximum
Cased: −20°C to +55°C maximum

STORAGE TEMPERATURE: −40°C to +85°C

ISOLATION VOLTAGE: A maximum of 500 volts can be connected between the chassis and either output terminal.

SPECIFICATIONS, Performance

CONTROLS: PWR Modules are supplied with a built-in ±5% trimmer adjustment which operates for voltage or current

All models are designed for continuous operation without derating under all specified line, load and temperature conditions.

control. The main output control is exercised by means of external resistances which may be fixed, stepped or variable. A fixed 1% resistor, selected to program the rated output voltage is supplied with each module. Stability and temperature coefficient criteria require the use of high quality LTC, 20PPM wire-wound elements for programming.

PROGRAMMING: Terminals provide for resistive programming of voltage or current at approximately 1000 ohms per volt. Programming terminals are also provided for programming by means of remotely located voltage or current signals. Output current derates linearly with voltage (see operating region characteristic). The current cutoff setting automatically tracks the voltage to provide proportionally constant overload protection.

OVERLOAD PROTECTION: The cutoff current limit is adjustable from approximately 5% to 105% of the rated output current. When overloaded, output current reduces along the cutoff line to approximately 5% of the rated maximum into a short circuit. Cutoff should be set to exceed the maximum expected *operating* current (I_{LIMIT}) by an amount equal to 5% of the *maximum* current rating of the power supply.

The negative resistance character of the cutoff locus may cause severely non-linear loads (requiring large starting surge currents) to "lock out" for certain settings of the cutoff current limit. For such loads, a series starting resistance can be used to limit the starting surge so that operation can be contained within the shaded region of the graph. Some examples of non-linear loads are: high intensity filament lamps and motors.

REMOTE ERROR SENSING: Error sensing terminals enable specified voltage regulation to be maintained directly at the load by compensating for voltage drops up to 0.5 volts across each load supply lead.

SERIES/PARALLEL OPERATION: Connections provided for series/parallel operation of identical units using master/slave configurations.

CONVECTION COOLING: Heat removal is by natural convection.

OVERSHOOT: No output voltage overshoot from turn-on, turn-off or power failure for output settings above 25% of maximum rated voltage. Below 25%, output overshoot is a function of load and is negligible for loads in excess of 10%.

SPECIFICATIONS, Physical

TERMINALS AND CONTROLS: *On Rear of Chassis:* Barrier strip terminals provide for AC input, DC output, remote error sensing, programming and ground terminals. Output terminals are isolated from ground, either positive or negative output may be grounded.

DIMENSIONS: *Uncased:* 6¾" H x 4¾" W x 10⅜" D
Cased: 6 15/16" H x 5" W x 10 7/16" D

STANDARD FINISH: *Chassis:* cadmium plated, cronak wash. *Case:* blue finished aluminum (special finishes to order).

ACCESSORIES: *Cased Units:* To specify cased unit, add suffix "C" to the model no. eg: PWR 15-6C for module with case. Case includes wrap-around, end plate and 4 removable feet for bench use.

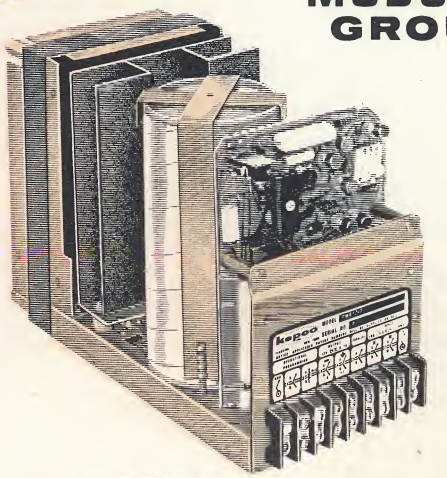
RACK ADAPTERS:
RA 8-2: (5¼" H x 19" W) accommodates 2 PWR modules.
RA 9-3: (7" H x 19" W) accommodates 3 PWR modules.
RA 10-1: (5¼" H x 19" W) accommodates 1 PWR module.
Finish: Frosty etch, clear epoxy coating. (special finishes to order). See Accessory Page 47 for outline dimensions.

CUSTOM OPTIONS: Special models available with custom ratings. Contact your nearest Kepco sales engineer with your special requirements.

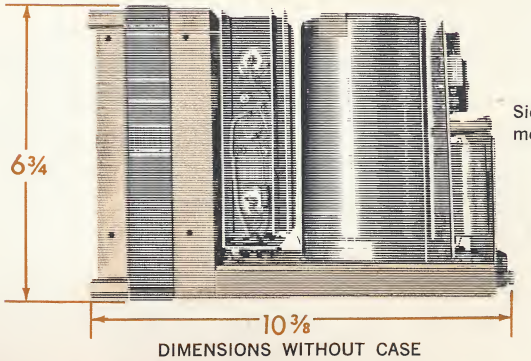
TRANSISTORIZED

kepco PWR REGULATED DC SUPPLY

MODULAR GROUP

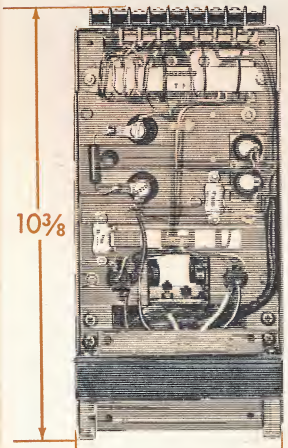


Uncased unit
Model PWR 12–7

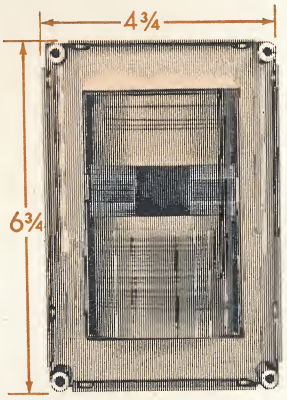


Side mounting

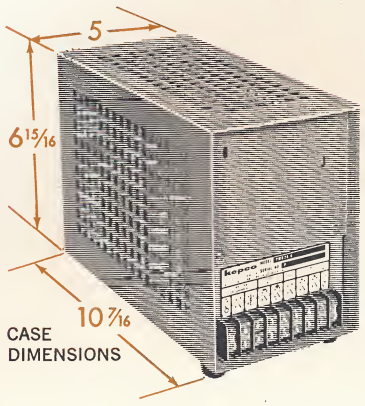
DIMENSIONS WITHOUT CASE



Bottom mounting



End mounting



CASE DIMENSIONS

Data subject to change without notice
PATENT NOTICE: Applicable Patent Nos. will be supplied on request.

kepco

SM

REGULATED DC SUPPLY

GROUP

TRANSISTORIZED

- *wide voltage range*
- *high current*
- *dual regulator*
- *minimum regulator dissipation*

REGULATION
0.01% LINE — 0.05% LOAD

SPECIFICATIONS, General

REGULATION:

LINE: 0.01% output voltage change for 105—125V AC line variation at any output voltage within the specified range.

LOAD: 0.05% or 1 millivolt output voltage change, whichever is greater, for NO LOAD to FULL LOAD change at any output voltage within the specified range.

STABILITY:

Output varies less than 0.05% or 3 millivolts, whichever is greater, over a period of 8 hours after warmup. Measured at constant line voltage, load and ambient temperature.

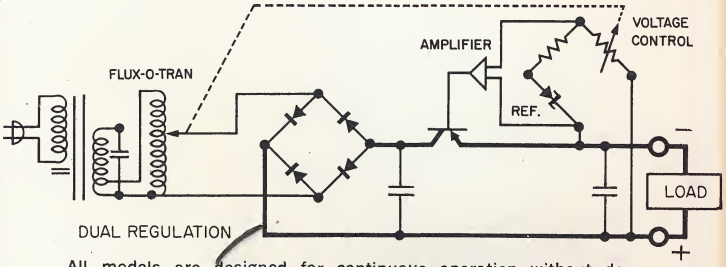
RIPPLE:

Less than 1 millivolt rms.

MODEL	DC OUTPUT RANGE		OUTPUT IMPEDANCE OHMS MAX.			DIMENSIONS			MAX. INPUT AMPS At 125 V AC
	VOLTS	AMPS	DC to 100 CPS	100 CPS to 1 KC	1 KC to 100 KC + μH	H″	W″	D″	
SM 14—7M	0—14	0—7	0.001	0.005	0.1 +0.4	3½	19	13⅞	3.5
SM 14—15M	0—14	0—15	0.0005	0.005	0.02+0.4	5¼	19	13⅞	5.5
SM 14—30M	0—14	0—30	0.0003	0.005	0.02+0.1	8¾	19	13⅞	10.5
SM 36—5M	0—36	0—5	0.005	0.005	0.03+0.4	3½	19	13⅞	4.0
SM 36—10M	0—36	0—10	0.003	0.005	0.03+0.4	5¼	19	13⅞	6.5
SM 36—15M	0—36	0—15	0.002	0.005	0.03+0.4	8¾	19	13⅞	10.5
SM 75—2M	0—75	0—2	0.02	0.005	0.04+0.4	3½	19	13⅞	4.0
SM 75—5M	0—75	0—5	0.01	0.005	0.02+0.4	5¼	19	13⅞	6.5
SM 75—8M	0—75	0—8	0.005	0.005	0.06+0.5	8¾	19	13⅞	10.0
SM 160—1M	0—160	0—1	0.1	0.005	0.04+0.5	3½	19	13⅞	3.5
SM 160—2M	0—160	0—2	0.05	0.005	0.04+0.4	5¼	19	13⅞	5.5
SM 160—4M	0—160	0—4	0.02	0.005	0.06+1.0	8¾	19	13⅞	10.5
SM 325—0.5M	0-165-325	0—0.5	0.4	0.005	0.1 +1.0	3½	19	13⅞	3.5
SM 325—1M	0—325	0—1	0.2	0.005	0.1 +1.0	5¼	19	13⅞	5.0
SM 325—2M	0—325	0—2	0.1	0.005	0.1 +1.0	8¾	19	13⅞	11.0

0.01% LINE AND LOAD REGULATION MODELS AVAILABLE:

All of the listed SM Power Supplies available in a 0.01% regulated version on special order. Designate by adding the suffix "X" after the model number: e.g. SM 160-4MX. The "X" version has improved load regulation, rated 0.01% or 1 millivolt, whichever is greater, and improved stability, rated 0.01% or 2 millivolts over 8 hours.



All models are designed for continuous operation without derating under all specified line, load and temperature conditions.

RECOVERY TIME:
50 microseconds.

TEMPERATURE COEFFICIENT:
Output voltage changes less than 0.05% per °C.

AMBIENT OPERATING TEMPERATURE:
—20°C to +50°C maximum. Protective circuit turns unit "off" should an over-temperature condition occur. Reset with power on-off switch.

STORAGE TEMPERATURE:
—40°C to +85°C maximum.

OUTPUT IMPEDANCE:
Specified for each model within the load frequency range shown in the table. Above 10 kc include the reactive impedance of the effective series inductance as indicated.

Data subject to change without notice
PATENT NOTICE: Applicable Patent Nos. will be supplied on request.

kepco®

INPUT REQUIREMENTS:

105—125V AC 60±1 cps single phase.

Units operate within regulation specification for short term line frequency changes within the range 57—63 cps (except 325V Models).

For models to operate at 104 ± 9V AC; 115 ± 10V AC; 208 ± 18V AC or 230 ± 20V AC, 50 cps ±1 cps add suffix "—50" to the model number and derate output *voltage* by 20%.

SPECIFICATIONS, Performance

CONTROLS:

Continuously adjustable 5-turn voltage control permits output settings from zero to the maximum output voltage. Resolution: 0.1% of maximum output voltage.

REMOTE ERROR SENSING:

Separate sensing terminals enable specified voltage regulation to be maintained directly at the load by compensating for voltage drops up to 0.5 volts across the load supply leads.

COOLING:

Lateral circulation by blowers insures efficient heat transfer; permits stacking of units without overheating.

OVERSHOOT:

No output voltage overshoot from turn-on, turn-off or power failure for output settings above 25% of max. rated voltage. Below 25%, output overshoot is a function of load and is negligible for loads in excess of 10%.

ISOLATION VOLTAGE:

A maximum of 400 volts can be connected between the chassis and either output terminal.

SPECIFICATIONS, Physical

METERS:

Model numbers in table include 2½" voltmeter and ammeter; 2% full scale accuracy. To specify unmetered unit, delete the suffix "M" from the model number, eg., SM 160-1 for unit without meters.

TERMINALS AND CONTROLS:

On front panel: DC output and ground (5-way) terminals. 5-turn continuously variable voltage control, power on-off switch (dual voltage range switch on SM 325-0.5M)

On rear of chassis: DC output and ground (5-way) terminals. Remote error sensing terminals. All output terminals are isolated from the chassis, either positive or negative terminal may be grounded. Three wire safety ground line cord.

DIMENSIONS:

Standard EIA rack dimensions.

See table for specification of each model. Depth is measured behind front panel.

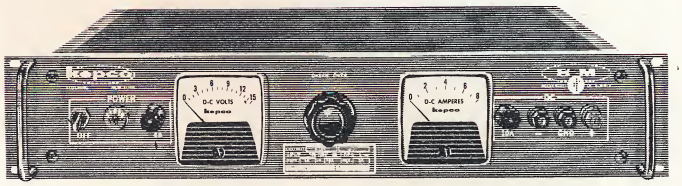
STANDARD FINISH:

Gray hammertone (special finishes to order)

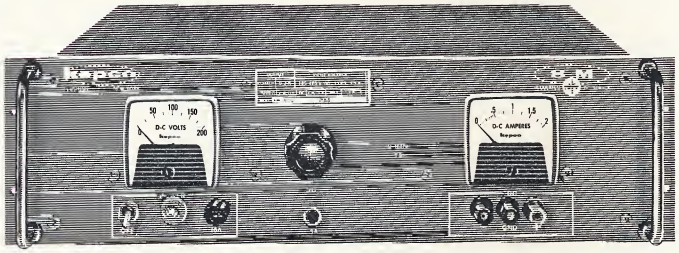
131-38 SANFORD AVENUE • FLUSHING, N.Y. 11352 • Phone: (212) IN 1-7000
TWX #212-539-6623 • Cable Address: KEPCOPOWER, NEWYORK

TRANSISTORIZED

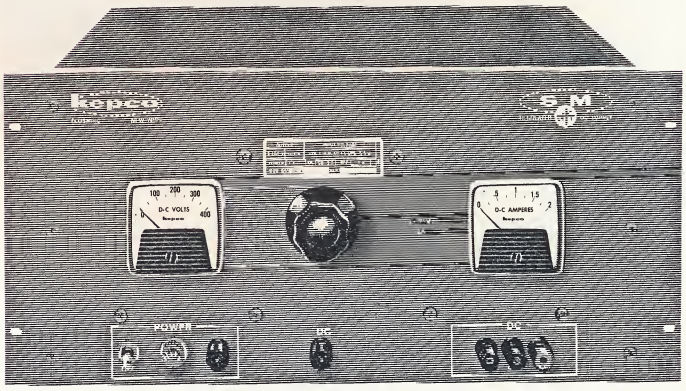
kepco SM REGULATED DC SUPPLY GROUP



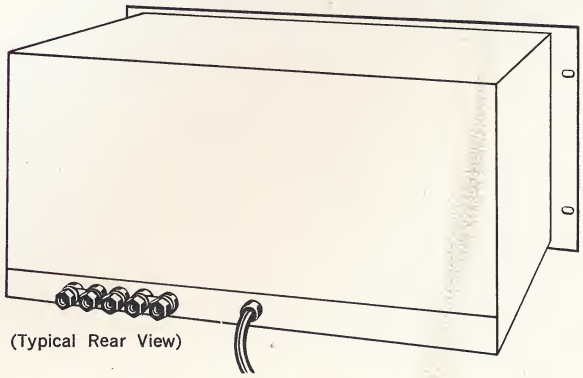
Model SM 14-7M



Model SM 160-2M



Model SM 325-2M



(Typical Rear View)

kepco

WR

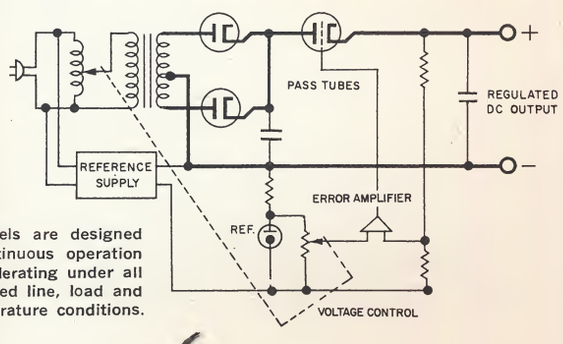
REGULATED DC SUPPLY

GROUP

VACUUM TUBE

<0.1% REGULATION and STABILITY

MODEL	DC OUTPUT RANGE VOLTS	DC OUTPUT RANGE MA.	REGULATION LOAD O-MAX %	REGULATION LOAD O-MAX ΔV	REGULATION LINE %	REGULATION LINE ΔV	RIPPLE RMS MV	OUTPUT IMPEDANCE OHMS MAX. DC to 100 CPS	OUTPUT IMPEDANCE OHMS MAX. 100 CPS to 1 KC	OUTPUT IMPEDANCE OHMS MAX. 1 KC to 100 KC + μH	AUX. OUTPUT 6.3VAC Unregulated	DIMENSIONS H	DIMENSIONS W	DIMENSIONS D	MAX. INPUT AMPS At 125 V AC
2400 B #1	Bias														
	0–150	0–5	*	*	*	*	1	*	*	*		10½″	19″	17⅞″	5.0
#2	0–400	0–150	0.025	0.1	0.1	0.4	3	0.7	0.05	0.2+2	10 AMP				
#3	0–400	0–150	0.025	0.1	0.1	0.4	3	0.7	0.05	0.2+2	10 AMP				
Parallel #2 & #3	0–400	0–300	0.025	0.1	0.1	0.4	3	0.35	0.05	0.2+2					
Series #2 & #3	0–800	0–150	0.025	0.2	0.1	0.8	6	1.4	0.1	0.4+4					
400 B	0–400	0–150	0.025	0.1	0.1	0.4	3	0.7	0.05	0.2+2	10 AMP	7″	19″	11⅞″	3.0
	Bias														
	0–150	0–5	*	*	*	*	1	*	*	*					
430 D #1	0–450	0–300	0.025	0.1	0.1	0.4	3	0.38	0.05	0.2+2	10 AMP	12¼″	19″	17⅞″	8.0
#2	0–450	0–300	0.025	0.1	0.1	0.4	3	0.38	0.05	0.2+2	10 AMP				
Parallel #1 & #2	0–450	0–600	0.025	0.1	0.1	0.4	3	0.19	0.05	0.2+2					
Series #1 & #2	0–900	0–300	0.025	0.2	0.1	0.8	6	0.76	0.1	0.4+4					
800 B #1	0–600	0–200	0.02	0.1	0.1	0.4	3	0.6	0.05	0.2+2	10 AMP	12¼″	19″	17⅞″	7.5
#2	0–600	0–200	0.02	0.1	0.1	0.4	3	0.6	0.05	0.2+2	10 AMP				
Parallel #1 & #2	0–600	0–400	0.02	0.1	0.1	0.4	3	0.3	0.05	0.2+2					
Series #1 & #2	0–1200	0–200	0.02	0.2	0.1	0.8	6	1.2	0.1	0.4+4					
605	0–600	0–500	0.02	0.1	0.1	0.4	3	0.24	0.05	0.2+2	20 AMP	10½″	19″	17⅞″	8.0
	Bias														
	0–150	0–5	*	*	*	*	1	*	*	*					
615B	0–600	0–300	0.02	0.1	0.1	0.4	3	0.4	0.05	0.2+2	10 AMP	10½″	19″	13⅞″	6.0
	Bias														
	0–150	0–5	*	*	*	*	1	*	*	*					
103 #1	0–300	0–75	Common B-				30	—	—	—	5 AMP	8″	16″	8″	1.5
#2	0–300	0–75					30	—	—	—					
#3	-50to+50	0–5	#3 isolated from #1 and #2			Unregulated	10	—	—	—		Rack Adapter RA-1 Available, See Accessory Page			
Parallel #1 & #2	0–300	0–150					30	—	—	—					
1250 B ✧	0–1000	0–500	0.01	0.1	0.05	0.4	3	0.2	0.1	1.0+2		28″	22″	15½″	12.5
1220 C	0–1200	0–50	0.01	0.1	0.05	0.4	3	2.4	0.2	1.0+2	10 AMP	10½″	19″	13″	3.0
1520 B ✧	0–1500	0–200	0.01	0.1	0.05	0.4	3	0.75	0.3	1.0+5		23″	22″	15½″	7.0
HB 2050 ✧	0–2000	0–500	0.005	0.05	0.01	0.1	3	0.2	0.5	2.0+5		33½″	22″	18″	24.0
HB 2500	0–2500	0–50	0.005	0.05	0.01	0.05	5	2.5	0.5	2.0+5		8¾″	19″	17″	5.0



All models are designed for continuous operation without derating under all specified line, load and temperature conditions.

SPECIFICATIONS, General

REGULATION:

(See table) the regulation of each model is specified as a percentage or minimum absolute change for 105—125V AC line variations and NO LOAD to FULL LOAD change. Percentage values measured to maximum rated output voltage.

STABILITY:

Output varies less than percent regulation specification or 100 millivolts whichever is greater over a period of 8 hours after warmup. Measured at constant line voltage, load and ambient temperature.

RIPPLE:

See table for maximum specification applicable to each model.

RECOVERY TIME:

50 microseconds.

TEMPERATURE COEFFICIENT:

Output voltage changes less than 0.01% per °C.

AMBIENT OPERATING TEMPERATURE:

−20°C to +55°C maximum.

STORAGE TEMPERATURE:

−40°C to +85°C maximum.

OUTPUT IMPEDANCE:

Specified for each model within the load frequency range shown in the table.

Above 10 kc include the reactive impedance of the effective series inductance as indicated.

INPUT REQUIREMENTS:

105—125V AC 50—65 cps single phase.

Units are available with 50—440 cps input tolerance on special order.

* REGULATION FOR BIAS OUTPUTS:

In the range 0—150V DC the output voltage variation is less than 0.01% for line fluctuations from 105 to 125 volts. At 150 volts the output varies less than 2% for load changes from 0—5 milliamperes. At settings below 150 volts, the internal resistance of the bias supply increases to a maximum of 25,000 ohms. The bias output is a negative potential derived from a VR tube energized by a regulated supply; it is referred to the negative output terminal of the main supply. The nominal maximum output voltage is 150V DC and can be anywhere in the range 140-165V DC.

kepco®

SPECIFICATIONS, Performance

CONTROLS:

Continuously adjustable single-turn voltage control permits output settings from zero to the maximum output voltage. Models 2400B, 430D, 800B and HB 2500 incorporate coarse and fine adjustments. The fine controls cover a range of approximately 1% of rated maximum output voltage. (Fine controls available for all other models on special order.)

Resolution: 0.5% of maximum output voltage. Units with fine controls have a resolution of 0.005% of maximum output voltage.

CONVECTION COOLING:

Heat removal is by natural convection, no blowers.

ISOLATION VOLTAGE:

A maximum of 400 volts can be connected between the chassis and either output terminal.

SPECIFICATIONS, Physical

METERS:

Model numbers in table include voltmeter and ammeter, (except Model 103, supplied unmetered only).

TERMINALS AND CONTROLS:

On front panel: DC output and ground (5-way) terminations, 6.3V AC output terminals (where applicable), AC on-off switch, pilot light and fuse. DC on-off switch, pilot light and fuse. Voltage controls. For Models 2400 B, HB 2050 and HB 2500, output terminals are provided at the rear only.

On rear of chassis: DC output and ground terminations, 6.3 V AC output terminals (where applicable). For Model 103, output terminals are provided on the front panel only. All output terminals are isolated from the chassis, either positive or negative output may be grounded.

DIMENSIONS:

Standard EIA rack dimensions. See table for specification of each model. Depth is measured behind front panel.

Models marked with a ✧ are supplied in cabinets. The chassis, when removed from their cabinets will mount directly into a standard 19″ wide equipment rack.

The equipment dimensions are:

	H	W	D
1250B	26¼″	19″	13⅞″
1520B	21″	19″	13⅞″
HB 2050	31½″	19″	17⅞″
103	(Use with Rack Adapter RA-1)		

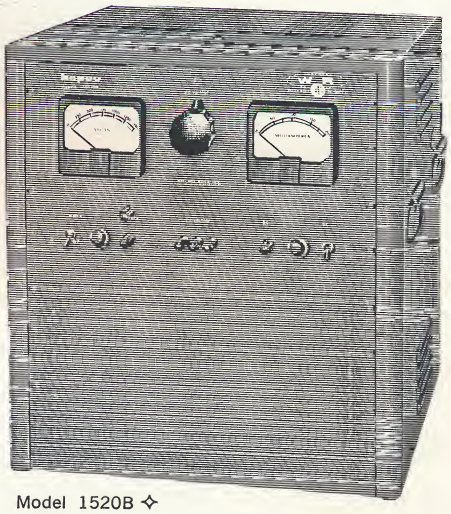
STANDARD FINISH:

Gray hammertone (special finishes to order).

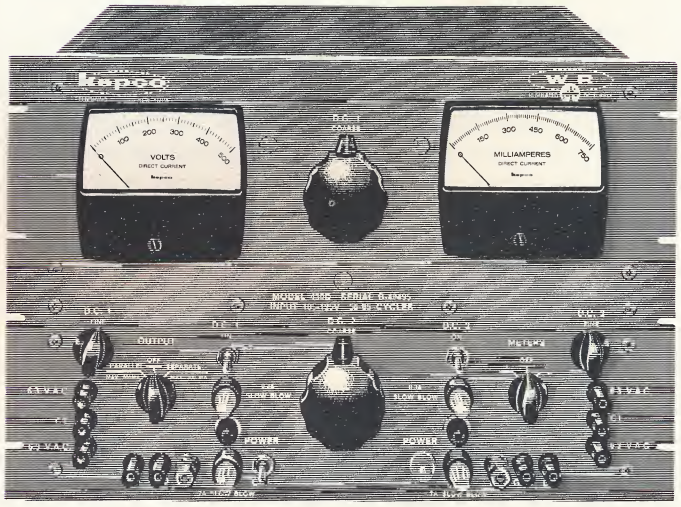
131-38 SANFORD AVENUE • FLUSHING, N.Y. 11352 • Phone: (212) IN 1-7000
TWX #212-539-6623 • Cable Address: KEPCOPOWER, NEWYORK

VACUUM TUBE

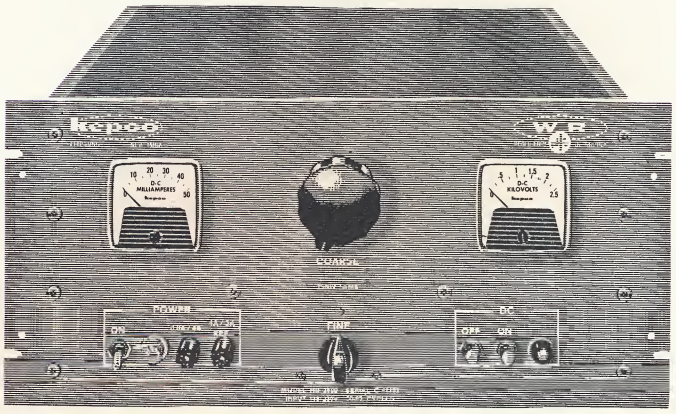
kepco
W R
REGULATED DC SUPPLY
GROUP



Model 1520B ✧



Model 430D



Model HB 2500

GLOSSARY OF POWER SUPPLY TERMS

This glossary is published to assist the engineer in the proper application and understanding of Kepco Regulated Power Supplies. The glossary gives the precise definitions and meaning for every term that is used in describing and specifying Kepco Power Supplies.

ACCURACY:

Accuracy, used as a specification for the output voltage of fixed voltage power supplies, refers to the absolute voltage tolerance with respect to the stated nominal output.

AMBIENT OPERATING TEMPERATURE (Range):

The range of environmental temperatures in which a power supply can be safely operated. For units with forced air cooling, the temperature is measured at the air intake.

BRIDGE CURRENT:

The circulating control current in the comparison bridge; bridge current equals the reference voltage divided by the reference resistor. Typical values are 1 ma, 3.3 ma and 10 ma corresponding to control ratios of 1000 ohms/volt, 300 ohms/volt and 100 ohms/volt respectively.

CALIBRATION, PROGRAMMING:

Calibration with reference to power supply programming describes the adjustment of the control bridge current to calibrate the programming ratio in ohms per volt. Many programmable supplies incorporate a "calibrate" control as part of the reference resistor which performs this adjustment.

COMPARISON BRIDGE:

A type of voltage comparison circuit whose configuration and principle of operation resemble a four-arm electrical bridge (*Figure 1*). The elements are so arranged that, assuming a balance exists in the circuit, a virtual zero error signal is derived. Any tendency for the output voltage to change in relation to the reference voltage creates a corresponding error signal, which, by means of negative feedback, is used to correct the output in the direction toward restoring bridge balance. This comparison bridge is capable of achieving better than 0.01% regulation and stability. (*See Error Signal.*)

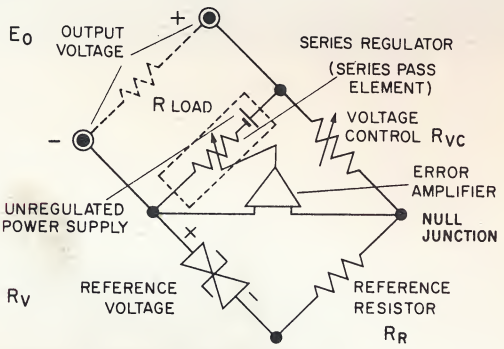


Figure 1: Comparison Bridge for constant voltage operation.

COMPLEMENTARY TRACKING:

A system of interconnection of two regulated supplies in which one (the master) is operated to control the other (the slave). The slave supply voltage is made equal (or proportional) to the master supply voltage and of opposite polarity with respect to a common point.

COMPLIANCE EXTENSION:

A form of master/slave interconnection of two or more current regulated power supplies to increase their compliance voltage range through series connection.

COMPLIANCE VOLTAGE:

The output voltage of a DC power supply operating in constant current mode. The compliance range is the range of voltages needed to sustain a given value of constant current throughout a range of load resistances.

CONSTANT CURRENT POWER SUPPLY (Current Regulator):

A power supply capable of maintaining a preset current through a variable load resistance. This is achieved by automatically varying the load voltage in order to maintain the ratio V_{load}/R_{load} constant.

CONSTANT VOLTAGE POWER SUPPLY (Voltage Regulator):

A power supply that is capable of maintaining a preset voltage across a variable load resistance. This is achieved by automatically varying the output current in order to maintain the product of load current times load resistance constant.

CONTROL RATIO:

The required change in control resistance to produce a one volt change in the output voltage. The control ratio is expressed in ohms per volt and is the reciprocal of the bridge current.

COOLING:

In power supplies, the cooling of regulator elements refers to the method used for removing heat generated in the regulating process. Methods include radiation, convection, and conduction or combinations thereof.

COOLING, CONVECTION:

A method of heat transfer which uses the natural upward motion of air warmed by the heat dissipators.

COOLING, LATERAL FORCED AIR:

An efficient method of heat transfer by means of side to side circulation which employs blower movement of air through or across the heat dissipators.

CROSSOVER (Automatic) VOLTAGE/CURRENT:

The characteristic of a power supply that automatically changes the method of regulation from constant voltage to constant current (or vice versa) as dictated by varying load conditions. (*Figure 2*). The constant voltage and constant current levels can be independently adjusted within the specified voltage and current limits of the power supply. The intersection of constant voltage and constant current lines is called the crossover point (V, I) and may be located anywhere within the volt-ampere range of the power supply.

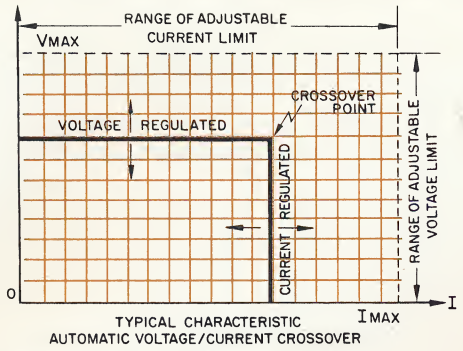


Figure 2: Automatic voltage/current crossover.

CURRENT LIMITING (Automatic):

An overload protection mechanism which limits the maximum output current to a preset value, and automatically restores the output when the overload is removed (*See Short Circuit Protection, Figure 3*).

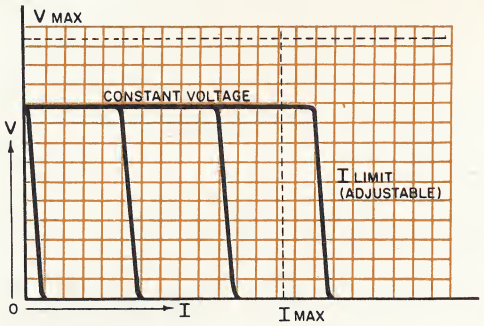


Figure 3: Plot of typical current limiting curves.

CURRENT SENSING RESISTOR:

A resistor placed in series with the load to develop a voltage proportional to load current. A current regulated DC power supply regulates the current in the load by regulating the voltage across the sensing resistor.

"DELTA", MINIMUM

A qualifier, often appended to a percentage specification to describe that specification when the parameter in question is a variable, and particularly when that variable may approach zero. The qualifier is often known as the "minimum delta V", or "minimum delta I" as the case may be.

DRIFT:

See Stability

ERROR SIGNAL:

The error signal is the difference between the output voltage and a fixed reference voltage compared in ratio by the two resistors at the null junction of the comparison bridge $\epsilon = E_O - E_R\left(\frac{R_{VC}}{R_R}\right)$, *see Figure 1,*

The error signal is amplified to drive the series pass elements and correct the output.

HYBRID:

A combination of disparate elements to form a common circuit. In power supplies, the combination of vacuum tubes and transistors in the regulating circuitry.

LINEARITY, PROGRAMMING:

The linearity of a programming function refers to the correspondence between incremental changes in the input signal (resistance, voltage or current) and the consequent incremental changes in power supply output. Direct programming functions are inherently linear for the Kepco Bridge regulator, and are accurate to within a percentage equal to the supply's regulating ability.

LINE REGULATION:

The maximum steady state amount that the output voltage or current will change as the result of a specified change in line voltage (usually for a step change between 105-125 or 210-250 volts, unless otherwise specified. Regulation is given either as a percentage of the output voltage or currnt, and/or as an absolute change, ΔV or ΔI.

LOAD REGULATION:

The maximum steady state amount that the output voltage or current will change as the result of a specified change in output load, generally from no-load to full-load unless otherwise specified. Regulation is given either as a percentage of the output voltage or current and/or as an absolute change, ΔV or ΔI.

MASTER-SLAVE OPERATION:

A system of interconnection of two regulated power supplies in which one, (the master), operates to control the other, (the slave). Specialized forms of the master-slave configuration are used for: *Complementary Tracking* (plus and minus tracking around a common point); *Parallel Operation,* to obtain increased current output for voltage regulation; *Compliance Extension,* to obtain increased voltage output for current regulation.

MODULAR:

The term "modular" is used to describe a type of power supply designed to be built into other equipment, either chassis or rack mount. It is usually distinguished from laboratory bench equipment by a large choice of mounting configurations and by a lack of meters and controls.

NULL JUNCTION:

That point on the Kepco bridge at which the reference resistor, the voltage control resistance and one side of the comparison amplifier coincide. The null junction is maintained at almost zero potential and is a "virtual ground".

OUTPUT IMPEDANCE:

The effective dynamic output impedance of a power supply is derived from the ratio of the measured peak-to-peak change in output voltage to a measured peak-to-peak change in alternating load current. Output impedance is usually specified throughout the frequency range DC−100 kc.

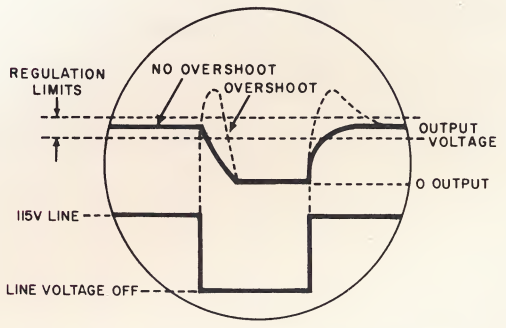


Figure 4: Scope view of turn off-turn on effects on supply.

OVERSHOOT:
A transient rise beyond regulated output limits, occurring when the AC power input is turned on or off, and for line or load step changes. (*See Figures 4, 6a, 6b*).

OVER-TEMPERATURE PROTECTION:
A thermal relay circuit which turns off the power automatically should an over-temperature condition occur.

PARALLEL OPERATION:
Voltage regulators, connected together so that their individual output currents are added and flow in a common load. Several methods for parallel connection are used: spoiler resistors, master/slave connection, and automatic crossover. Current regulators can be paralled without special precaution. (*See Application Notes, Pages 8-12.*)

PASS ELEMENT:
A controlled variable resistance device, either a vacuum tube or power transistor, in series with the source of DC power. The pass element is driven by the amplified error signal to increase its resistance when the output needs to be lowered or to decrease its resistance when the output must be raised. (*See Series Regulator.*)

POWER SUPPLY (AC TO DC):
Generally, a device consisting of transformer, rectifier and filter for converting available AC to a prescribed DC voltage or current.

PROGRAMMING:
The control of any power supply functions, such as output voltage or current, by means of an external or remotely located variable control element. Control elements may be variable resistances, conductances, or variable voltage or current sources. (*Figure 5.*)

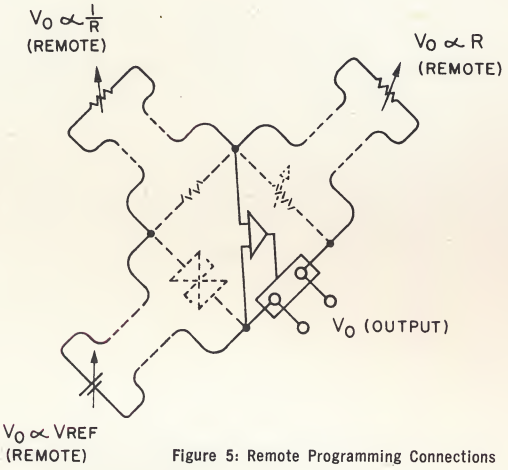


Figure 5: Remote Programming Connections

PROGRAMMING SPEED:
Programming Speed describes the time required to change the output voltage of a power supply from one value to another. The output voltage must change across the load and because the supply's filter capacitor forms an RC network with the load and internal source resistance, programming speed can only be described as a function of load. (*See Application Notes, Pages 8 to 12*). Programming speed is the same as the "recovery time" specification for *current regulated* operation; it is not related to the recovery time specification for voltage regulated operation.

RECOVERY TIME (Current Regulation):
Specifies the time needed for the output current to return to a value within the regulation specification after a step load or line change. For load change, current will recover at a rate governed by the rate-of-change of the compliance voltage across the load. This is governed by the RC time constant of the output filter capacitance, internal source resistance and load resistance. *See Programming Speed* in the Application Notes, (*Pages 8 to 12*).

RECOVERY TIME (Voltage Regulation):
Specifies the time needed for the output voltage to return to a value within the regulation specification after a step load or line change. Recovery time, rather than response time, is the more meaningful and therefore preferred way of specifying power supply performance, since it relates to the regulation specification. (*Figures 6a and 6b.*)

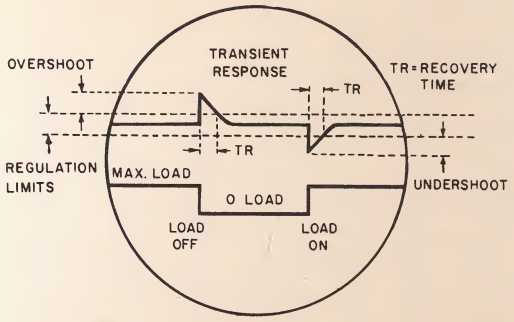


Figure 6a: Scope view shows the effects of a step load change.

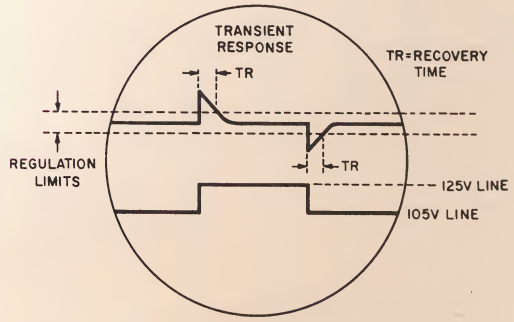


Figure 6b: Scope view shows the effects of a step line change.

REGULATED POWER SUPPLY:
A power supply which maintains a constant output voltage (or current) for changes in the line voltage, output load, ambient temperature or time.

REGULATION:
The maximum amount that the output will change as a result of the specified change in line voltage, output load, temperature or time. Line regulation, load regulation, stability, and temperature coefficient are defined and usually specified.

REMOTE ERROR SENSING:
A means by which the regulator circuit senses the voltage directly at the load. This connection is used to compensate for voltage drops in the connecting wires.

RESPONSE TIME (Time Constant):
Specifies the time required for the voltage or current excursion to be reduced to 37% of its peak value after a step load or line change.

RESOLUTION:
The minimum voltage (or current) increment within which the power supply's output can be set using the panel controls. For continuous controls, the minimum increment is taken to be the voltage (or current) change caused by 1 degree of shaft rotation.

RIPPLE:
Stated either in peak-to-peak or in rms value, "ripple" specifies the maximum AC component that appears in a DC output. Unless specified separately, ripple includes unclassified noise.

SERIES OPERATION:
The output of two or more power supplies connected together to obtain a total output voltage equal to the sum of their individual voltages. Load current is equal and common through each supply. The extent of series connection is limited by the maximum specified potential rating between any output terminal and ground. For series connection of current regulators, master/slave (compliance extension) or automatic crossover is used.

SERIES REGULATOR:
A device placed in series with a source of power that is capable of controlling the voltage or current output by automatically varying its series resistance. (*See Pass Element.*)

SHORT CIRCUIT PROTECTION (Automatic):
Any automatic current limiting system which enables a power supply to continue operating at a limited current, and without damage, into any output overload including short circuits. The output voltage must be restored to normal when the overload is removed, as distinguished from a fuse or circuit-breaker system which opens at overload and must be closed to restore power. (*See Current Limiting, Figure 3.*)

SHUNT REGULATOR:
A device placed across the output, which controls the current through a series dropping resistance to maintain a constant voltage or current output.

SLAVED TRACKING:
A system of interconnection of two or more regulated supplies in which one (the master) operates to control the others (the slaves). The output voltages of the slave units may be equal or proportional to the output voltage of the master unit. (The slaved output voltages track the master output voltage in a constant ratio.) (*See Complementary Tracking and Master/Slave.*)

SPOILER RESISTORS:
Resistors used to "spoil" the load regulation of feedback regulated power supplies to permit parallel operation when not otherwise provided for.

STABILITY, LONG TERM (LTS):
The change in output voltage or current as a function of time, at constant line voltage, load and ambient temperature (sometimes referred to as drift).

STEP LINE VOLTAGE CHANGE:
An instantaneous change in line voltage (e.g., 105-125V AC); for measuring line regulation and recovery time.

STEP LOAD CHANGE:
An instantaneous change in load current (e.g., 0 to full load); for measuring the load regulation and recovery time.

STORAGE, TEMPERATURE:
The range of environmental temperatures in which a power supply can be safely stored (e.g., −40°C to +85°C).

TEMPERATURE COEFFICIENT (TC):
The % change in the output voltage or current as a result of a 1°C change in the ambient operating temperature (% per °C).

TEMPERATURE, OPERATING:
The range of environmental temperatures in which a power supply can be safely operated (e.g., −20°C to +50°C). *See Ambient Operating Temperature (Range).*

VIX, INDICATORS:
Voltage/Current Crossover Indicators. VIX indicators are a pair of small mode lamps on the front panel of automatic crossover power supplies. One lamp lights during voltage regulated operation of the power supply; the other lamp lights during current regulated operation.

VIX SIGNAL:
A keyed voltage, whose polarity is an indication of power supply output voltage/current regulation mode. The polarity abruptly reverses at the crossover point and can be used to actuate external mechanisms such as lamps, alarms, etc.

VOLTAGE CORRECTOR:
An active source of regulated power placed in series with an unregulated supply to sense changes in the output voltage (or current); and to correct for these changes by automatically varying its own output in the opposite direction, thereby maintaining the total output voltage (or current) constant.

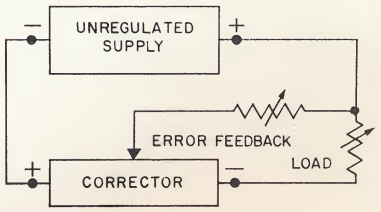


Figure 7: Circuit used to sense output voltage changes.

VOLTAGE REFERENCE:
A separate, highly regulated voltage source used as a standard to which the output of the power supply is continuously referred.

WARM-UP TIME:
The time (after power turn-on) required for the output voltage, or current to reach an equilibrium value within the stability specification.

PROGRAMMABLE VOLTAGE/CURRENT MODELS

AUTOMATIC VOLTAGE/CURRENT CROSSOVER (INTERNAL SENSING)					EXTERNALLY SENSED CONSTANT CURRENT	
MODEL	VOLTAGE RANGE VOLTS	CURRENT RANGE AMPS	% LOAD* REGULATION VOLTAGE MODE	% LOAD* REGULATION CURRENT MODE✧	CURRENT RANGE AMPS	% LOAD* REGULATION CONSTANT CURRENT
CK 2–8M	0–2	0.016 –8	0.01	0.01 or 0.2ma	0.001–8	0.01
CK 8–5M	0–8	0.010 –5	0.01	0.01 or 0.2ma	0.001–5	0.01
CK 18–3M	0–18	0.006 –3	0.01	0.01 or 0.2ma	0.001–3	0.01
CK 36–1.5M	0–36	0.003 –1.5	0.01	0.01 or 0.2ma	0.001–1.5	0.01
CK 40–0.8M	0–40	0.0016–0.8	0.01	0.01 or 0.2ma	0.001–0.8	0.01
CK 60–0.5M	0–60	0.001 –0.5	0.01	0.01 or 0.2ma	0.001–0.5	0.01
KS 8–15M	0–8	0.075–15	0.01	0.01 or 1ma	0.01–15	0.01
KS 8–25M	0–8	0.125–25	0.01	0.01 or 1ma	0.01–25	0.01
KS 8–50M	0–8	0.25 –50	0.01	0.01 or 1ma	0.01–50	0.01
KS 8–100M	0–8	0.50 –100	0.01	0.01 or 1ma	0.01–100	0.01
KS 18–10M	0–18	0.05 –10	0.01	0.01 or 1ma	0.01–10	0.01
KS 18–15M	0–18	0.075–15	0.01	0.01 or 1ma	0.01–15	0.01
KS 18–25M	0–18	0.125–25	0.01	0.01 or 1ma	0.01–25	0.01
KS 18–50M	0–18	0.25 –50	0.01	0.01 or 1ma	0.01–50	0.01
KS 36–5M	0–36	0.025–5	0.01	0.01 or 1ma	0.01–5	0.01
KS 36–10M	0–36	0.05 –10	0.01	0.01 or 1ma	0.01–10	0.01
KS 36–15M	0–36	0.075–15	0.01	0.01 or 1ma	0.01–15	0.01
KS 36–30M	0–36	0.15 –30	0.01	0.01 or 1ma	0.01–30	0.01
KS 60–2M	0–60	0.01 –2	0.01	0.01 or 1ma	0.01–2	0.01
KS 60–5M	0–60	0.025–5	0.01	0.01 or 1ma	0.01–5	0.01
KS 60–10M	0–60	0.05 –10	0.01	0.01 or 1ma	0.01–10	0.01
KS 60–20M	0–60	0.1 –20	0.01	0.01 or 1ma	0.01–20	0.01
KO 12–100M	0–12	10–100	1	2 or 200ma	–	–
KO 25–50M	0–25	5–50	1	2 or 200ma	–	–
KO 45–30M	0–45	3–30	1	2 or 200ma	–	–
KO 70–20M	0–70	2–20	1	2 or 200ma	–	–

✧Whichever is greater.

*For detailed regulation specifications refer to the individual model specification page.

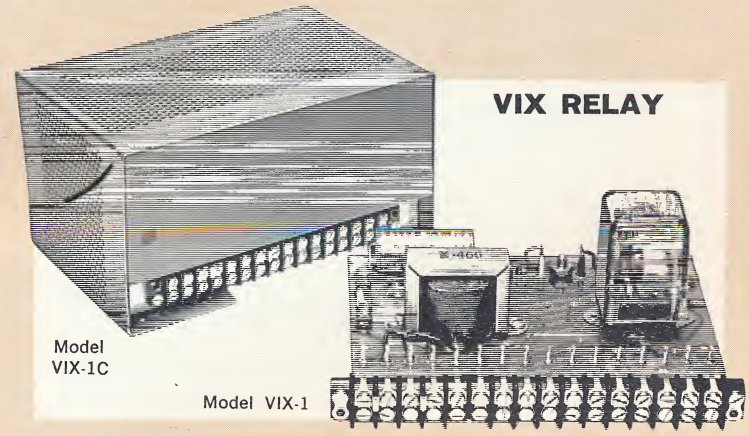
EXTERNALLY SENSED CONSTANT CURRENT				EXTERNALLY SENSED CONSTANT CURRENT			
MODEL	VOLTAGE RANGE VOLTS	CURRENT RANGE AMPS	% LOAD* REGULATION CONSTANT CURRENT	MODEL	VOLTAGE RANGE VOLTS	CURRENT RANGE AMPS	% LOAD* REGULATION CONSTANT CURRENT
ABC 2–1M	0–2	0.001–1	0.5	HB 8AM	0–325■	0.01–0.8	0.01
ABC 7.5–2M	0–7.5	0.001–2	0.5	HB 250M	0–250■	0.01–1	0.01
ABC 10–0.75M	0–10	0.001–0.75	0.5	HB 525M	0–525■	0.01–0.5	0.01
ABC 15–1M	0–15	0.001–1	0.5	PAX 7–1	0–7	0.001–1	0.1
ABC 18–0.5M	0–18	0.001–0.5	0.5	PAX 14–0.75	0–14	0.001–0.75	0.1
ABC 30–0.3M	0–30	0.001–0.3	0.5	PAX 21–0.5	0–21	0.001–0.5	0.1
ABC 40–0.5M	0–40	0.001–0.5	0.5	PAX 36–0.3	0–36	0.001–0.3	0.1
ABC 100–0.2M	0–100	0.001–0.2	0.5	PAX 72–0.15	0–72	0.001–0.15	0.1
ABC 200M	0–200	0.001–0.1	0.1	PAX 100–0.1	0–100	0.001–0.1	0.1
ABC 425M	0–425	0.001–0.05	0.1	PWR 12–7	0–12■	0.001–7	0.1
ABC 1000M	0–1000	0.001–0.02	0.1	PWR 15–6	0–15■	0.001–6	0.1
ABC 1500M	0–1500	0.001–0.01	0.1	PWR 24–4	0–24■	0.001–4	0.1
ABC 2500M	0–2500	0.001–0.002	0.1	PWR 28–3.3	0–28■	0.001–3.3	0.1
HB 2AM	0–325■	0.01–0.2	0.01	PWR 48–2	0–48■	0.001–2	0.1
HB 4AM	0–325■	0.01–0.4	0.01	PWR 60–1.5	0–60■	0.001–1.5	0.1
HB 6AM	0–325■	0.01–0.6	0.01				

■For voltage compliance versus output current consult derating graphs on HB and PWR specification pages.

*For detailed regulation specifications refer to the individual model specification page.

ACCESSORY EQUIPMENT

VIX RELAY



Model VIX-1C translates the VIX REMOTE SIGNAL available on all CK and KS VIX-equipped power supplies into a heavy duty relay closure for external control or signal applications.

SPECIFICATIONS

INPUT: ±8V DC at 1 ma (from VIX signal).

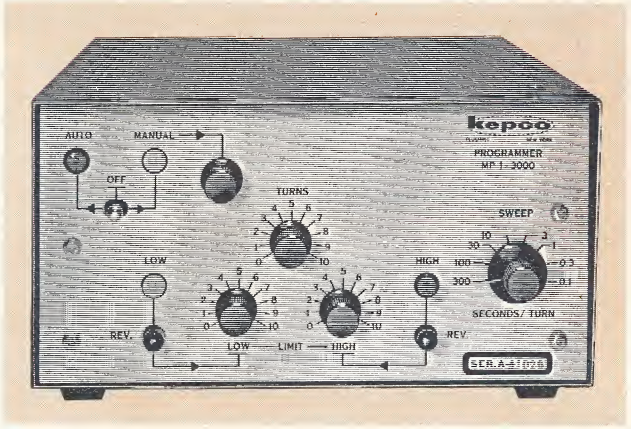
OUTPUT: Three pole, double throw relay contacts; each rated to carry 10 amperes at 115V AC or 5 amperes at 230V AC.

POWER REQUIREMENTS: 105-125V or 210-250V AC

SIZE: 4¼" H x 8$^{5}/_{32}$" W x 5" D (5⅝" D overall) Standard half-rack configuration).

MOUNTING: In the half-rack enclosure VIX-1C can be mounted in either RA-4 or RA-5 rack adapters.
The enclosure is removable so that the circuit board, which is complete by itself, can be mounted within other equipment or chassis. To designate model without enclosure, delete the suffix "C", e.g., Model VIX-1, for unenclosed circuit board for "built-in" mounting.

MOTORIZED PROGRAMMER
MODEL MP-1-3000



Model MP-1-3000 is a mechanically driven resistance programmer suitable for use with any Kepco programmable power supply or resistance driven mechanism. It consists of a synchronous motor which drives a precision 10-turn servo-mount potentiometer through a multi-speed reversible gear box.

SPECIFICATIONS

OUTPUT RANGE: The output is a variable resistance which can be selected from among the following standard values:

10 ohms, 25 ohms, 50 ohms, 100 ohms, 200 ohms, 500 ohms, 1000 ohms, 2000 ohms, 5000 ohms, 10K, 20K, 30K, 50K, 75K, 90K, 100K and 125K.

The selected resistance represents the full range resistance of available potentiometers. Designate when ordering by appending the resistance value to the model number, for example: for a 10,000 ohm potentiometer, order MP-1-3000-10 K. Other resistance values available on special order.

SPEEDS: 8 speeds from 300 seconds per revolution (3000 seconds for the full 10 turns) to 0.1 seconds per revolution (1 second full range), switch selected from the front panel: 300 sec/rev, 100 sec/rev, 30 sec/rev, 10 sec/rev, 3 sec/rev, 1 sec/rev, 0.3 sec/rev and 0.1 sec/rev. Other speeds available on special order.

TIMING: Programming speeds referenced to 60 cps line frequency. Overall timing accuracy better than ±5% at 60 cps line frequency.

LIMITS: Mechanically adjustable high and low limit switches automatically reverse the direction of rotation of the potentiometer shaft when it reaches the respective limit points. The limits can be set to restrict shaft travel from 10 revolutions to as little as ¼ revolution, in any portion of the 10-turn sweep range.

OVERRIDE: Manual override buttons permit the operator to reverse the program direction at any desired point, or to stop the mechanism at will.

DIRECTIONAL LAMPS: Two pilot lights are employed to signal the direction of potentiometer rotation.

STOP: The mechanical programmer can be stopped — either electrically or manually at any point in its sweep range. While stopped, the program shaft can be manually rotated.

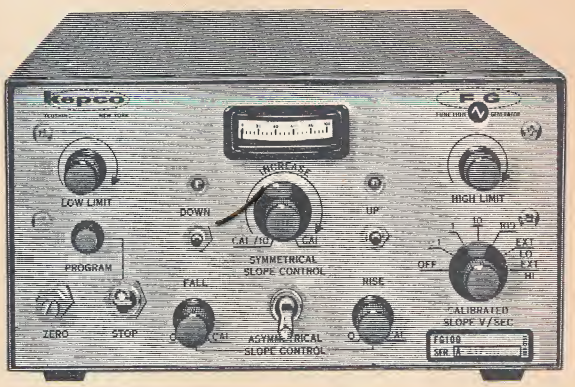
PROGRAMMING: When used to program the voltage or current function of any Kepco supply, the potentiometer resistance should be selected by multiplying the desired maximum output voltage by the control ratio of the supply in question. For example: to program up to 40 volts from a Kepco Model ABC 40-0.5M, a 40K potentiometer is required (40V x 1000 ohms per volt); choose 50K, the closest standard value.

Potentiometers are easily interchanged to control a variety of power supplies and functions.

INPUT REQUIREMENTS: 105-125V AC, 60 cps.

SIZE: 4¼" H x 8$^{5}/_{32}$" W x 9" D (9⅜" overall); standard half-rack configuration; fits Rack Adapters RA-4 or RA-5.

PROGRAMMER FUNCTION GENERATOR, MODEL FG-100



Model FG-100 is a precision, slow speed, triangular waveform generator capable of generating any repetitive ramp function. Separately adjustable, high and low limits, are provided which periodically reverse the direction of the integration. The rising rate and falling rate are separately adjustable or can be controlled symmetrically with a single control.

SPECIFICATIONS

OUTPUTS:

#1 — 0-20V DC, 0-20 ma.

#2 — 0-10 ma to program 100 ohm/volt power supply.

#3 — 0-1 ma to program 1000 ohm/volt power supply.

All outputs available simultaneously.

INPUT: 105-125V or 210-250V AC, 50-440 cps.

TIMING: 4 ranges: 0.1V/sec., 1.0V/sec., 10V/sec., 100V/sec.

Rising and falling slopes continuously adjustable between ranges either separately or symmetrically. For outputs #2 and #3, divide the above timing by 2000 and 20,000 respectively to obtain milliamperes per second.

LIMITS: Separately adjustable high limit and low limit permits operation between any two pre-set voltages or currents.

REVERSING SWITCHES: Programming direction is automatically reversed at the high and low limits. In addition, a pair of push buttons are provided which permit the direction to be reversed at any point in the operating span. A pair of directional lamps are provided to show the direction of the ramp.

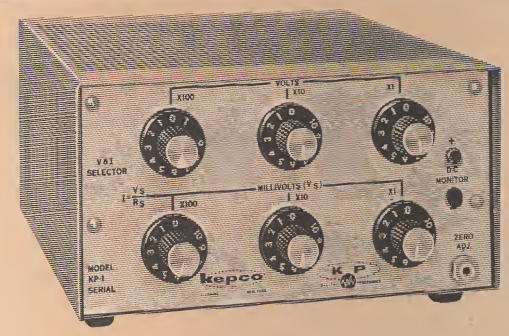
METER: 2½" edgewise meter monitors output in volts (0-20V DC) and in percent of maximum output, 0-100%.

PROGRAMMING: Model FG-100 may be used by itself to generate a wide variety of very low speed triangular or sawtooth functions, or it can be used directly with any programmable DC power supply. When connected to a programmable power supply, the Model FG-100 Function Generator programs the power supply throughout all or part of its rated voltage or current range as set by the power supply's controls and the function generator's limit settings. NOTE: function speed is converted to programming speed by multiplying the driving current rate (ma/sec.) by the resistance setting of the voltage control of the power supply being programmed. This gives the programming speed of the power supply's output in volts per second.

REMOTE CONTROLS: Timing and limit setting controls are brought to a multi-terminal barrier strip at the rear of the unit for remote operation. A sync output is also provided as is provision for remote directional signals.

SIZE: 4¼" H x 8$\frac{5}{32}$" W x 13" D (13⅜" D overall); standard half-rack configuration, fits Rack Adapters RA-4 and RA-5.

PROGRAMMING PANELS



MODEL KP-1 for use with Kepco ABC, CK and PAX Groups of Regulated Power Supplies. (1 milliampere Kepco Bridge Circuit).

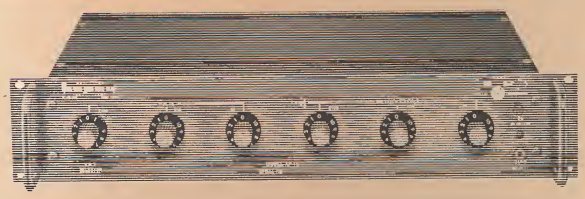
SPECIFICATIONS: MODEL KP-1

DECADES: 6-digit voltage programming. 3-digit current programming.

RANGE: 0-1,011,110 ohms in 1 ohm steps (0 to 1,011.110V in 1 millivolt steps at 1000Ω/V).

ACCURACY: Decades contain 0.1% resistor except units decade (millivolts) which contain 1% resistors.

SIZE: Half-rack, 4¼"H x 8$\frac{5}{32}$"W x 9⅝"D. Fits Rack Adapters RA-4 or RA-5.



MODEL KP-10 for use with Kepco HB and KS Groups of Power Supplies. (10 milliampere Kepco Bridge Circuit.)

SPECIFICATIONS: MODEL KP-10

DECADES: 6-digit voltage programming. 3-digit current programming.

RANGE: 0-101,111.0 ohms in 0.1 ohm steps (0-1,011.110V in 1 millivolt steps at 100Ω/V.)

ACCURACY: All decades contain 0.1% resistors.

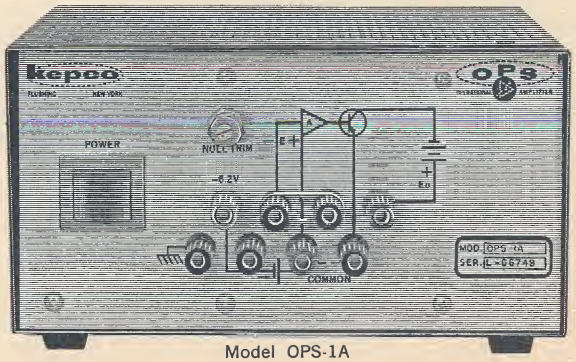
SIZE: 3½"H x 19"W x 11"D. Standard rack mount configurations.

Both decade programmers contain provision for current programming using the first three digits. This assumes a 1 volt sensing drop (internal or external). If the recommended 10 volt sample is employed for HB and ABC high voltage hybrids, then a fourth digit can be used for higher resolution.

When substituted in place of a power supply's normal voltage control and calibrated, the KP-1/KP-10 digital decade programmer converts that supply to a highly accurate voltage or current source.

Both programmers contain zero trimming controls which, in conjunction with the power supplies own bridge current adjustment, allow precise calibration of the output at minimum and maximum output. The programming function of the Kepco bridge is inherently linear to an accuracy determined by the load/line regulation of the power supply. This means that the circuit accuracy is, for all intents and purposes, limited solely by the resistors used in the programmer.

OPERATIONAL POWER SUPPLY, MODEL OPS-1



Model OPS-1A

The Model OPS-1 is a self-powered, 1 watt *Operational Power Supply* consisting of a unipolar operational amplifier, power amplifier, and all necessary regulated power supplies. OPS-1 is designed for both bench and system applications using a variety of available housings and accessories. It can be used for most operational amplifier computational function, especially those requiring a relatively high output power level. OPS-1 is particularly designed for use with Kepco operationally programmable power supplies in signal processing, translation and driving functions. A built-in voltage reference is provided for use in nulling systems, or as a highly regulated voltage or current reference source.

SPECIFICATIONS:

OUTPUT VOLTAGE: 0-20 volts, unipolar.

OUTPUT CURRENT: 0-50 ma.

ADJUSTABLE CURRENT LIMITING: 25% to 125%, fully protected for all conditions of loading, from open to short circuits.

POWER REQUIREMENTS: 105-125 or 210-250V AC, 50-440 cps.

OPEN LOOP DC GAIN: In excess of 80 db.

BANDWIDTH, UNITY GAIN: 200 kc.

BANDWIDTH FOR 20V EXCURSION: 1 kc (no load) ; 0.1 kc (400Ω load).

BANDWIDTH FOR 1 VOLT EXCURSION: 20 kc (no load) ; 2 kc (400Ω load).

MAXIMUM SLEWING RATE: 10^5 volts per second.

REGULATION AND STABILITY:
Changes referred to input offset voltage and loop current.
Line: Less than 10μV and 50 nA input change for 105-125V AC line variation.
Temperature: Less than 10μV and 50 nA input change per °C.
Stability: Less than 10μV and 50 nA input change over 8 hours at constant line voltage, load and ambient temperature.
Ripple and Noise: Less than 10μV.

BUILT-IN REFERENCE: -6.2V DC nominal (5.9-6.5V DC)
Reference Temperature Coefficient: 0.01% per °C.
Reference Stability: 0.01% per 8 hours for constant line, load and ambient temperature.

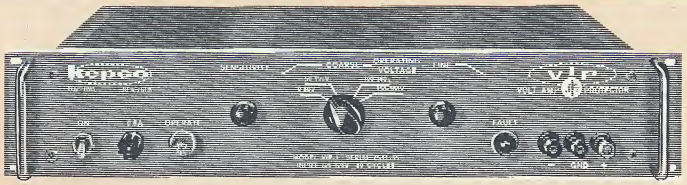
MAXIMUM CAPACITIVE LOADING: 0.001μf.

AMBIENT OPERATING TEMPERATURE RANGE: —20°C to +60°C.

STORAGE TEMPERATURE: —40°C to +85°C.

ENCLOSURES: OPS-1A, bench-style enclosure, 4¼" H x 8$^{5}/_{32}$" W x 5⅝" D, with binding posts, fits RA 4 and RA 5 Rack Adapters.
OPS-1B, plug-in housing, 2$^{11}/_{16}$"H x 4⅛"W x 13$^{3}/_{16}$" D. with binding posts, fits RA 6-6 Rack Enclosure.

OVER-VOLTAGE OVER-CURRENT PROTECTORS



MODEL VIP-1

OVER-VOLTAGE/OVER-CURRENT

MODEL VIP-3

OVER and UNDER-VOLTAGE/OVER and UNDER-CURRENT

DESCRIPTION:

The VIP consists of a sensing circuit capable of detecting a voltage 1% or 0.1 volts different than any preset voltage limit in the range 5—200 volts. Should such an over or under-voltage occur, a fast-acting silicon controlled rectifier (SCR) "crowbar" short circuits the power supply's output within 50 microseconds. Simultaneously a power interlock relay is tripped which removes the primary AC power within approximately 50 milliseconds. The SCR discharges the power supply's output filter capacitor and the voltage is reduced to zero.

Operation in the internal reference mode allows the operator to pre-set any voltage as a limit above or below which crowbar/turn-off action is precipitated. In its tracking mode, the VIP is interconnected with the voltage control circuit of the power supply with which it is used and will sense a voltage differential between the output of the supply and the programmed voltage.

Terminals are provided for the addition of a sensing resistor to convert VIP into an over-current or under-current protector depending on model. The current sensing resistor is chosen to drop 1 volt at the operating current. The sensitivity control then adjusts the firing threshold from 0 to the operating current, maximum 30 amperes.

SPECIFICATIONS:

VOLTAGE

SENSITIVITY: Minimum threshold 1% of operating voltage or 0.1 volts whichever is greater (adjustable).
RANGE: 0—50V*, 50—100V, 100—150V, 150—200V.
*Minimum voltage required for proper operation is 5V.

CURRENT

SENSITIVITY: 5% of operating current producing a 1 volt drop across external sensing resistor.
RANGE: 0—30 amperes.

POWER INTERLOCK RELAY

CONTACT RATING: 10 amperes at 115V AC.

DIMENSIONS

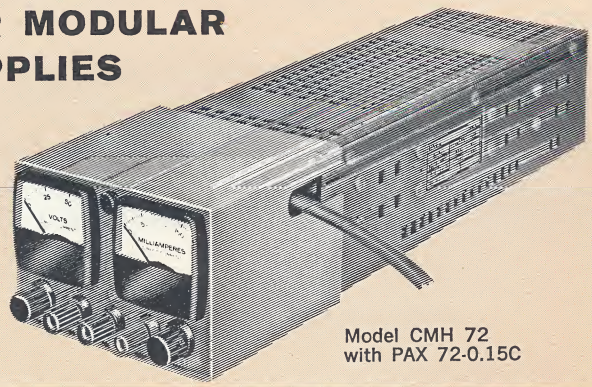
3½" high x 19" wide x 8" deep.
Standard EIA rack dimensions.

STANDARD FINISH:

Grey Hammertone (special finishes to order).

Note: Because PNP transistors are used as the series pass elements in Kepco All-Transistor Power Supplies; their reference polarity is reversed relative to Hybrid Models which employ a vacuum tube for this function. When a VIP is to be used in its "Tracking Mode" be sure to specify (when ordering) whether it is to be used with an All-Transistor or a Hybrid Power Supply.

ACCESSORY EQUIPMENT FOR MODULAR SUPPLIES



Model CMH 72
with PAX 72-0.15C

CMH mate with PAX power supplies to provide a convenient set of controls. CMH adds a 3-wire safety line cord, on-off switch, 10-turn precision voltage control, separate voltmeter and ammeter, and output binding posts. The CMH Control Assembly greatly enhances the flexibility of the PAX series power supplies. With the appropriate CMH, any PAX modular, plug-in power supply is instantly converted to a precision laboratory bench power supply.

CMH ADAPTER	PAX MODEL*	CMH ADAPTER	PAX MODEL*
CMH-7	PAX 7-1C	CMH-36	PAX 36-0.3C
CMH-15	PAX 15-0.75C	CMH-72	PAX 72-0.15C
CMH-21	PAX 21-0.5C	CMH-100	PAX 100-0.1C

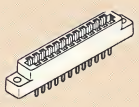
*CMH requires a cased PAX power supply (suffix "C").

STANDARD and HIGH-SPEED PAX REGULATORS

PAX Power Supplies consist of 2 parts, a PCB Regulator and a PS Power Source Assembly. Two PCB Regulators are available for each model, one for standard (voltage regulator) service and one for high-speed (HS) service. The HS Regulators are particularly useful in operational and current regulation applications.

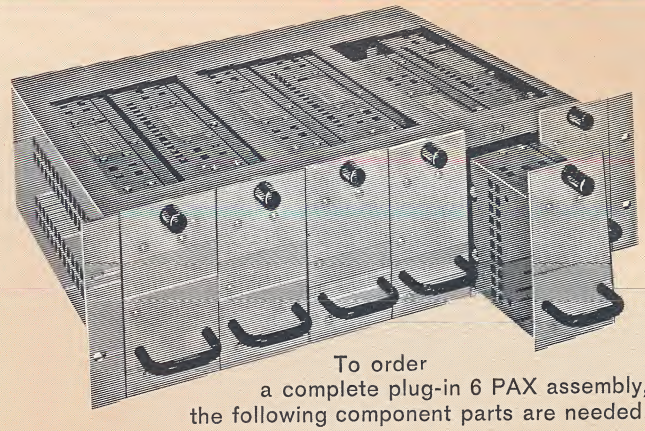
PCB and PCB-HS Regulators having the same voltage rating may be interchanged at will.

STANDARD REGULATORS	HIGH SPEED REGULATORS	POWER SOURCE ASSEMBLIES
PCB 7	PCB 7-HS	PS 7
PCB 15	PCB 15-HS	PS 15
PCB 21	PCB 21-HS	PS 21
PCB 36	PCB 36-HS	PS 36
PCB 72	PCB 72-HS	PS 72
PCB 100	PCB 100-HS	PS 100



PAX PLUG-IN CONNECTOR: PC-1

Available separately to mate with the printed circuit card of PAX Modules. Pin spacing 0.156", keyed on pin 7 (Equivalent to *Methode #CD612S P7* or *Cinch #250-12-37-200*).



To order a complete plug-in 6 PAX assembly, the following component parts are needed:

(6) Cased PAX power supplies (any mix). Use the suffix "C" to order cased units.

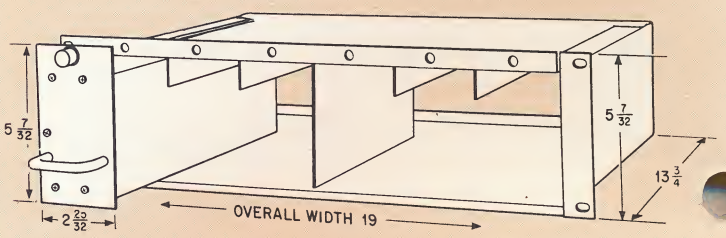
(6) Panel adapters, RAP 6-1.

(1) Rack enclosure, RA 6-6.

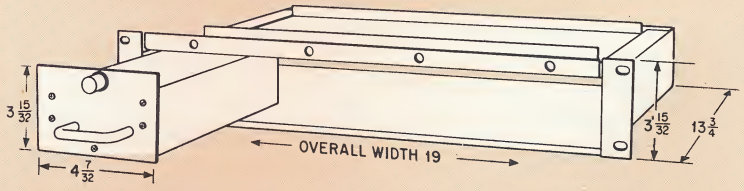
(1) Back plate, RA 6-6BP. Back plate contains 6 mounted PC-1 connectors. Separate connectors are not required when the back plate is ordered.)

If fewer than 6 power supplies are to be mounted, the 4-PAX enclosure, RA 7-4 may be used. Optionally, filler panels (RFP) can be ordered to fill blank spaces. Filler panels are similar to the panel adapters, except they are not drilled for power supply mounting. Filler panels can be used to mount accessory equipment into the rack enclosure.

RACK CABINET: RA 6-6 for mounting six units



RACK CABINET: RA7-4 for mounting four units



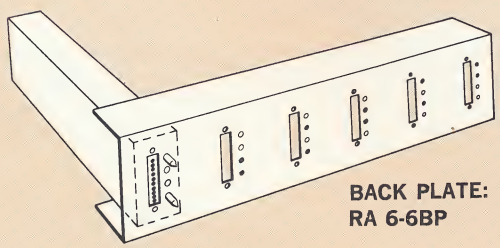
PANEL ADAPTERS: Required to mount PAX Modules in RA 6-6 and RA 7-4. Complete with handle and fastener.

RAP 6-1 Panel Adapter | **RAP 7-1** Panel Adapter

FILLER PANELS: Blank (undrilled) panel adapters with fastener to fill unused spaces in RA 6-6 or RA 7-4, can be used to mount other equipment in rack cabinets.

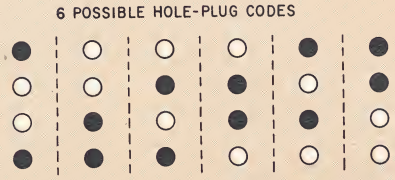
RFP 6-1	Single Filler	**RFP 7-1**	Single Filler
RFP 6-2	Double Filler	**RFP 7-2**	Double Filler
RFP 6-3	Triple Filler	**RFP 7-3**	Triple Filler

BACK PLATES: Complete with six and four connectors respectively, mate with PAX printed circuit card connectors, adapt the Rack Cabinets for plug-in mounting of the PAX Modules. Back plates are drilled with coding holes which allow the designer to restrict the interchangeability of modules at will.

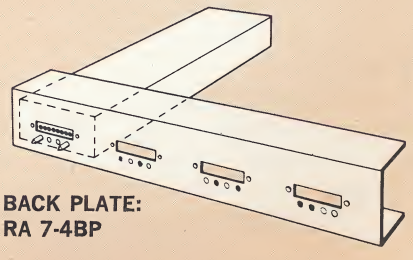


BACK PLATE: RA 6-6BP

6 POSSIBLE HOLE-PLUG CODES



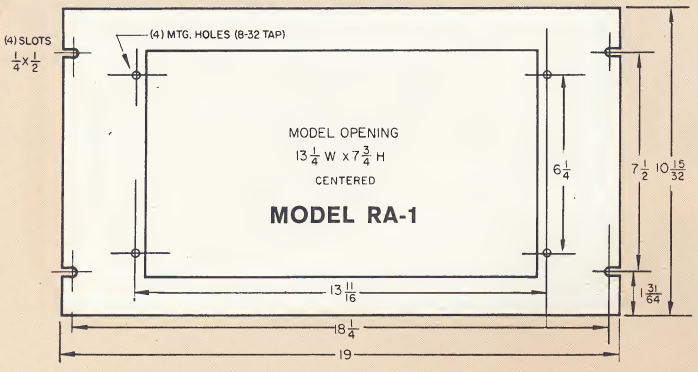
4 SOCKETS PROVIDED WITH 2 PINS AND 2 HOLE-PLUGS WHICH CAN BE INTERCHANGED TO CODE THE MOUNTING POSITIONS.

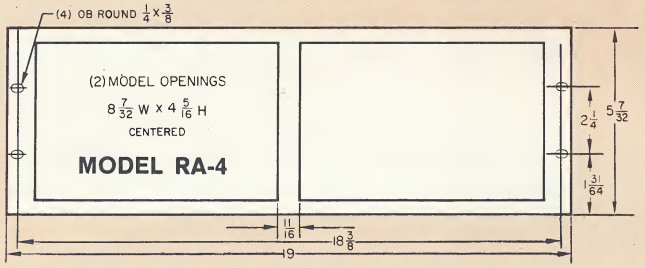


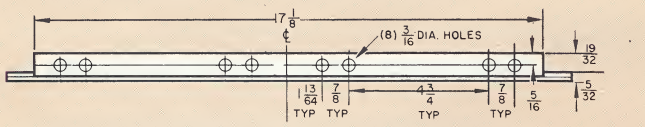
BACK PLATE: RA 7-4BP

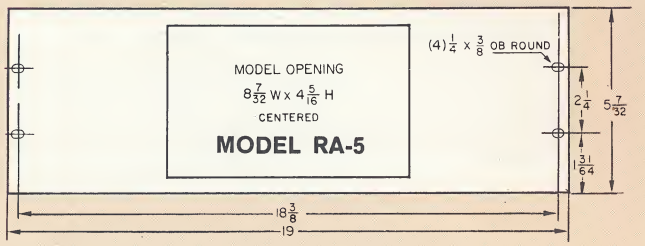
RACK ADAPTERS

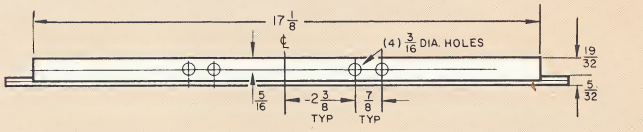
Rack Adapters are manufactured by Kepco to adapt bench style, modular, half-rack and Power Supplies to the standard 19″ wide equipment rack or cabinet.





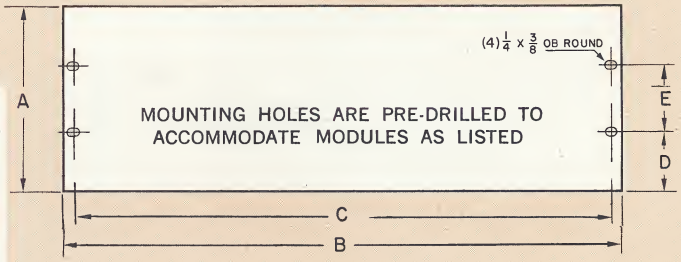






MODEL	HEIGHT	MOUNTING ARRANGEMENT	FOR USE WITH
RA 1	10½″	Single	Model 103
RA 4	5¼″	Dual	ABC and CK Models
RA 5	5¼″	Single	ABC and CK Models

FP 1 (Filler Panel for use with Rack Adapter RA 4)

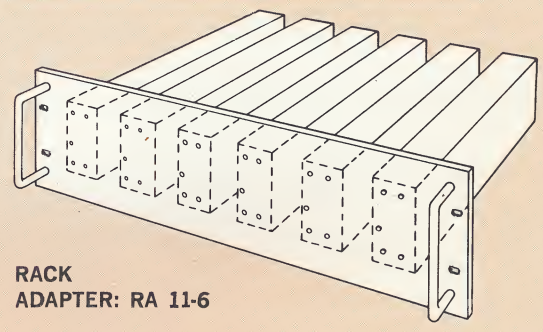


RACK ADAPTERS FOR PRM (Size A) and PWR MODULES

MODEL	DIMENSIONS A	B	C	D	E	MOUNTS
RA 10-1	5 7/32″	19″	18 3/8″	1 31/64″	2¼″	1 Module
RA 8-2	5 7/32″	19″	18 3/8″	1 31/64″	2¼″	2 Modules
RA 9-3	6 31/32″	19″	18 3/8″	1 31/64″	4″	3 Modules
RA 18-1	5 7/32″	19″	18 3/8″	1 31/64″	2¼″	1 Extra Filtered PRM Module

RACK ADAPTERS FOR PRM (Size B) MODULES

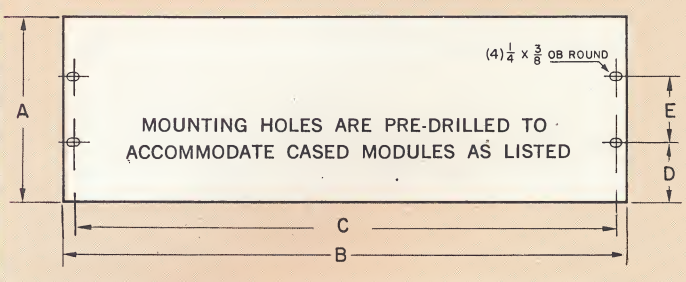
MODEL	DIMENSIONS A	B	C	D	E	MOUNTS
RA 15-1	3 15/32″	19″	18 3/8″	15/64″	3″	1 Module
RA 14-3	3 15/32″	19″	18 3/8″	15/64″	3″	3 Modules
RA 16-4	5 7/32″	19″	18 3/8″	1 31/64″	2¼″	4 Modules
RA 17-5	5 7/32″	19″	18 3/8″	1 31/64″	2¼″	5 Modules



RACK ADAPTER: RA 11-6

RACK ADAPTERS FOR CASED PAX MODULES (Suffix C)

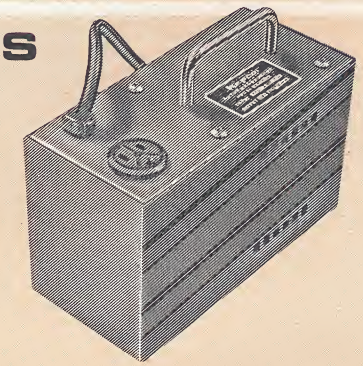
MODEL	DIMENSIONS A	B	C	D	E	MOUNTS
RA 12-1	3 15/32″	19″	18 3/8″	15/64″	3″	1 Module
RA 13-4	3 15/32″	19″	18 3/8″	15/64″	3″	4 Modules
RA 11-6	5 7/32″	19″	18 3/8″	1 31/64″	2¼″	6 Modules



AUTOTRANSFORMERS

MODEL	POWER	SIZE* L	W	D
AT–100	**100 VA**	5½″	2⅞″	2¾″
AT–250	**250 VA**	6″	3½″	3½″
AT–500	**500 VA**	7½″	3½″	4½″
AT–1000	**1000 VA**	8″	5¼″	5¼″
AT–1500	**1500 VA**	9¼″	5¼″	6½″

*Overall case dimensions (not including handle and feet)



Compact step-down Transformers provide 115V AC output from 220/230/240V AC (tap selected) 48—440 cps.

General Offices and Plant: KEPCO, INC. • 131-38 SANFORD AVENUE • FLUSHING, N.Y. 11352
Phone: (212) 461-7000 • TWX #212-539-6623 • Cable: KEPCOPOWER NEWYORK

kepco®

SALES REPRESENTATIVES

1. **N. Y. METROPOLITAN AREA and Northern New Jersey**
EASTERN INSTRUMENTATION, INC.
350 Northern Blvd., Great Neck, N.Y. 11021
N.Y. Phone: (516) 466-9505
N.J. Phone: (201) 779-1234

2. **TRUMBULL, CONNECTICUT**
RAY PERRON & COMPANY, INC.
36 Louis Street, Trumbull, Conn. 06611
(203) AM 8-9631

FARMINGTON, CONNECTICUT
RAY PERRON & COMPANY, INC.
10 Briarwood Road, Farmington, Conn. 06032
(203) OR 7-9025

3. **BOSTON, MASSACHUSETTS**
RAY PERRON & COMPANY, INC.
1870 Centre Street, Boston, Mass. 02132
(617) FA 3-1008 — TWX #617-325-8627

4. **MANCHESTER, NEW HAMPSHIRE**
RAY PERRON & COMPANY, INC.
19 Caron Road - Bedford RFD #2
Manchester, N.H. 03102
(603) 472-4091 — TWX #603-472-3960

5. **UTICA, NEW YORK**
NACO ELECTRONICS CORP.
2631 Edgewood Road, Utica, N.Y. 13501
(315) RE 2-1801

6. **SYRACUSE, NEW YORK**
NACO ELECTRONICS CORP.
119 Luther Avenue, Liverpool, N.Y. 13088
(315) GR 4-7481 — TWX #710-541-0439

7. **BINGHAMTON, NEW YORK**
NACO ELECTRONICS CORP.
4677 Vestal Pkway., East,
Binghamton, N.Y. 13903 (607) 729-6641

8. **ROCHESTER, NEW YORK**
NACO ELECTRONICS CORP.
74 Park Avenue, Rochester, N.Y. 14450
(716) GR 3-4169

9. **PHILADELPHIA, PENNA.**
EASTERN INSTRUMENTATION INC.
613 Cheltenham Avenue, Philadelphia, Pa. 19126
(215) WA 7-6269

10. **WASHINGTON, D. C.**
LEE ASSOCIATES, INC.
12250 Wilkins Avenue, Rockville, Md. 20852
(301) 949-4800 — TWX #301-949-6786

11. **WINSTON SALEM, N. C.**
LEE ASSOCIATES, INC.
P.O. Box 906, Winston Salem, N.C. 27101
(919) 724-2406

12. **ORLANDO, FLORIDA**
LEE ASSOCIATES, INC.
P.O. Box 7896, Orlando, Fla. 32804
(305) 241-4445 — TWX #305-275-1732

13. **HUNTSVILLE, ALABAMA**
LEE ASSOCIATES, INC.
P.O. Box 1506, Huntsville, Ala. 35807
(205) 881-0461—TWX #205-533-2066

14. **CINCINNATI, OHIO**
THE SATULLO COMPANY
618 Cincinnati-Batavia Pike, Cincinnati, Ohio 45244
(513) 752-6683

15. **CLEVELAND, OHIO**
THE SATULLO COMPANY
16801 Euclid Avenue, Cleveland, Ohio 44112
(216) IV 6-2800

16. **DETROIT, MICHIGAN**
THE SATULLO COMPANY
4514 N. Woodward Ave., Royal Oak, Mich. 48072
(313) LI 9-3910

17. **CHICAGO, ILLINOIS**
MIDWEST ELECTRONIC SALES
5707 W. Division St., Chicago, Ill. 60651
(312) 626-0030 — TWX #312 265-1415

INDIANAPOLIS, INDIANA
MIDWEST ELECTRONIC SALES
5462 E. 40th St., Indianapolis, Ind. 46226
(317) LI 7-3259

MILWAUKEE, WISCONSIN
MIDWEST ELECTRONIC SALES
1317 Garfield Ave., Waukesha, Wisc. 53186
(414) 542-5129

18. **ST. LOUIS, MISSOURI**
NORMAN W. KATHRINUS & COMPANY
2427 Brentwood Blvd., St. Louis, Mo. 63144
(314) WO 2-5627

19. **MINNEAPOLIS, MINNESOTA**
E. C. ELECTRONIC SALES
10108 Abbot Ave., So., Minneapolis, Minn. 55431
(612) 869-1144 — TWX #612-292-4195

20. **KANSAS CITY, KANSAS**
NORMAN W. KATHRINUS & COMPANY
P.O. Box 23, Kansas City, Kan. 66103
(913) AD 6-4108

21. **DALLAS, TEXAS**
AIREP ENGINEERING COMPANY
P.O. Box 9555, Dallas, Texas 75214
(214) TA 4-3800

22. **HOUSTON, TEXAS**
AIREP ENGINEERING COMPANY
P.O. Box 36211, Houston, Texas 77036
(713) GY 4-2260

23. **ALBUQUERQUE, NEW MEXICO**
V. T. RUPP COMPANY
9611 Acoma Rd., S.E. Albuquerque, N.M. 87112
(505) 298-5589 — TWX #505-243-8409

24. **DENVER, COLORADO**
D. E. BOND ASSOCIATES
5670 East Evans, Denver, Colo. 80222
(303) 756-1234

25. **SAN DIEGO, CALIFORNIA**
V. T. RUPP COMPANY
3445 Fifth Avenue, San Diego, Cal. 92103
(714) CY 8-9835 — TWX #714-291-0736
In Arizona: Call Phoenix Enterprise 1234

26. **LOS ANGELES, CALIFORNIA**
V. T. RUPP COMPANY
307 Parkman Avenue, Los Angeles, Cal. 90026
(213) DU 7-8224 — TWX #213-380-8840

27. **SAN FRANCISCO, CALIFORNIA**
V. T. RUPP COMPANY
1182 Los Altos Avenue, Los Altos, Cal. 94022
(415) 948-1483 — TWX #415-949-7950

28. **SEATTLE, WASHINGTON**
HARRY LEVINSON COMPANY
1211 East Denny Way, Seattle, Wash. 98122
(206) EA 3-5100 — TWX #206-998-1047

IN CANADA

29. **TORONTO, CANADA**
ATLAS INSTRUMENT CORPORATION
Division of Atlas Electronics Limited
50 Wingold Avenue, Toronto 19, Canada
(416) RU 1-6174 — Telex 02-2319

30. **MONTREAL, QUEBEC**
ATLAS INSTRUMENT CORPORATION
Division of Atlas Electronics Limited
3333 Cavendish Blvd., Montreal, Quebec
(514) HU 9-8495 — Telex 01-2141

31. **OTTAWA, ONTARIO**
ATLAS INSTRUMENT CORPORATION
Division of Atlas Electronics Limited
342½ Elgin Street, Ottawa, Ontario
(613) CE 3-9471

32. **VANCOUVER, B.C.**
ATLAS INSTRUMENT CORPORATION
Division of Atlas Electronics Limited
909 Beach Avenue, Vancouver, B.C.
(604) MU 4-7927

OVERSEAS OFFICES

GREAT BRITAIN
AD. AURIEMA, LTD.
Impectron House, 125 Gunnersbury Lane
Acton, London W.3, England
Tel. ACorn 8762; Cable: AIREMA LONDON,
Telex: 25864

BELGIUM, LUXEMBOURG, and the NETHERLANDS
AD AURIEMA — EUROPE S.A.
172a Rue Brogniez, Brussels 7, Belgium
Tel: 22-28-35, Cable: ADAURI BRUSSELS,
Telex: 21646

FRANCE
AD. AURIEMA — FRANCE, S.A.R.L.
243 bis, Boulevard Pereire, Paris 17, France
Tel: ETOile 12-49 or 15-51, Cable: ADAURIE

AUSTRIA AND SWITZERLAND
AD. AURIEMA — EUROPE, S.A.
Fleiner Strasse 17
7100 Heilbronn (Neckar), West Germany
Tel: (07131) 8-23-24, Telex: 728639

ITALY
AD. AURIEMA, INC.
Via Ferdinando di Savoia 2
Milan, Italy
Tel: 653, 106 Cable: FERCO MILAN

GERMANY
AD. AURIEMA — EUROPE, S.A.
Fleiner Strasse 17
7100 Heilbronn (Neckar), West Germany
Tel: (07131) 8-23-24, Telex: 728639

FOR OTHER FOREIGN COUNTRIES — CONTACT:

AD. AURIEMA, INC.
85 Broad Street, New York, N.Y. 10004
Tel: (212) BO 9-7750, Cable: AURIEMA, NEWYORK
Telex: RCA N.Y. 2791, TWX #710-581-3864

#146-1111
LITHO. IN U.S.A.